



FRIDAY, MAY 26, 1893

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## Contributions.

## Lighting Pullman Cars.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have received the letter from the New York Safety Heating & Lighting Company concerning my complaint about the bad lighting of Pullman cars, which appeared in your issue of May 5. I commend the spirit of the Pintsch people; they seem to want to know the facts and correct the faults. Unfortunately they cannot, for the lights of which I complained in that letter were of the carbureter kind and not Pintsch gas, and I judge that the Pintsch people would have no authority to do anything to better the operation of that light.

## A CASUAL DRUMMER.

[We have received from the Safety Car Heating & Lighting Company a communication on another subject which concerns that company. In the description of the Canadian Pacific World's Fair exhibit which appeared on page 369 of our last issue, the statement is made that the first class coach is lighted by either oil lamps or electricity. The Safety Car Heating & Lighting Company tells us that it has furnished equipment for lighting the Canadian Pacific cars at the World's Fair by Pintsch gas and that everything is on the cars but the lamps, which will be forwarded as soon as completed.—EDITOR RAILROAD GAZETTE.]

## Boiler Explosions on the Reading.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I was much struck by your note in the last issue, p. 380, on the number of locomotive boiler explosions on the Reading. Of course many of us have speculated as to the cause of a phenomenon so often noticed, for it is very evident that something serious is the matter. Either the Wooten boiler is very susceptible to that locomotive ailment, broken stays, or the inspection and repairs of boilers are very poorly carried out. It is, of course, impossible to believe that all these explosions arise from low water, and still more difficult to understand why the Reading engines should suffer more frequently from low water than those of other roads.

If there is anything about railroading that has been thoroughly and completely demonstrated, it is that locomotive boiler explosions can be almost completely prevented by proper precautions. Good design and workmanship, the use of materials of fair quality, and a careful internal inspection and hydraulic test at regular intervals, supplemented by a regular, frequent external examination for broken staybolts and other signs of weakness, have for years on scores of roads, proved absolutely efficient safeguards against locomotive boiler explosions.

In my scrapbook I find a newspaper account that states that a large "dirt burner" with a train of 30 empty cars blew up, killing the engineer and another runner, who was acting as pilot. Two other men were badly injured. One result of the accident was remarkable and unusual, for though the explosion blew the boiler off the frame, what remained of the engine went speeding down the track, finally coming to a standstill on an up grade three miles below.

MASTER MECHANIC.

## The Baldwin Locomotive "Columbia."

[WITH AN INSET.]

One of the interesting express locomotives at the World's Fair is the "Columbia," built by the Baldwin Locomotive Works, which is shown by the accompanying illustrations. The distinctive features of this engine are the front and back carrying wheels, the

compound cylinders, the large drivers with cast-steel centres, and the arrangement of the firebox, wholly back of the driving wheels. Some engines of this kind have been built by the Baldwin Locomotive Works for the Reading, and this type has been nicknamed the "Flying Dutchmen."

The main rod takes hold of the rear driver, and the parallel rod returns to the front driver. An equalizer distributes the weight between the truck wheels and the driving wheels, as may be desired. It is worthy of note that there is no equalizer between the driving wheels.

The engine has an extended smokebox with netting as usual. The smokebox front is of pressed steel, as also are the smokestack base and the dome casing. The safety valves are placed directly over the firebox, mainly for the purpose of reducing the height of the engine. In the firebox there is a firebrick arch; the crown is stayed by radial stays reduced at the centre.

The springs are placed under the driving axles, and the driving wheels pass up through the running board, and are covered with a casing. The arrangement of the spring hangers, links, crossheads and crossies is shown in the engravings. The swing motion of the truck, which is novel and ingenious, is also shown. The truck wheels are large, and pass through the front bumper, and are covered with a casing. The arrangement of the passages in the cylinders and the location of the piston valves and the interior of the smokebox are well shown in the engravings, and the perspective view from a photograph shows better than can be described the external peculiarities of this engine. The following are some of the principal dimensions, and the makers of some of the special materials entering into the construction of this engine:

Weight and General Dimensions.	
Total weight in working order (actual).....	126,640 lbs.
Total weight on driving wheels (actual).....	83,140 lbs.
Total wheel base of locomotive.....	24 ft. 7 in.
Distance between centres of driving wheels.....	7 ft. 4 in.
Centre of main driving wheels to centre of cylinders.....	13 ft. 2 in.
Main connecting rod from c. to c. of journals.....	8 ft. 9 1/2 in.
Centre to centre of cylinders.....	7 ft. 4 1/2 in.
Cylinders, Valves, etc.	
Diameter of cylinders.....	{ H. P. 13 in. L. P. 22 in.
Stroke of piston.....	26 in.
Horizontal thickness of piston over head and following plate.....	4 3/4 in.
Kind of piston packing.....	Cast-iron rings sprung into solid head
Diameter of piston rod.....	3 1/2 in.
Size of steam ports.....	24 x 1 1/2 in.
Size of exhaust ports.....	24 x 4 1/2 in.
Greatest travel of slide valves.....	5 1/4 in.
Outside lap of slide valves.....	{ H. P. 3/8 in. L. P. 1/2 in.
Inside lap of slide valves.....	{ L. P. none H. P. 1/8 in.
Lead of slide valves in full stroke.....	{ L. P. 3/8 in. H. P. 1/8 in.
Throw of upper end of reverse lever from full gear forward to full gear backward, measured on the chord of the arc of its throw.....	4 ft. 3 1/2 in.
Sectional area of opening in each steam pipe connected with cylinder.....	19.63 sq. in.
Wheels, etc.	
Diameter driving wheels outside of tires.....	84 1/4 in.
Diameter of truck wheels.....	54 1/4 in.
Diameter of trailing wheels.....	54 1/4 in.
Driving-axle journals.....	8 1/4 x 12 in.
Truck-axle journals.....	6 1/2 x 10 in.
Main crank pin journals.....	5 1/2 x 6 in.
Coupling-rod journals.....	front, 5 1/4 x 4 in.; back, 6 x 4 in.
Length of driving spring, c. to c. of hangers.....	48 in.
Driving, engine truck and trailing wheel-centres.....	Cast steel
Boiler.	
Description.....	Straight
Inside diameter smallest ring.....	51 1/2 in.
Material of barrel.....	Steel
Thickness of plates in barrel.....	3/8 in.
Horizontal seams.....	Butt-jointed, with double covering strips
Circumferential seams.....	Single and double riveted
Material of tubes.....	Iron, No. 12 B. W. G.
Number of tubes.....	198
Diameter of tubes outside.....	2 in.
Distance between centres of tubes.....	2 1/2 in.
Length of tubes over tube plates.....	13 ft. 1 1/2 in.
Length of firebox inside.....	84 1/2 in.
Width of firebox inside.....	42 1/2 in.
Depth of firebox from under side of crown plate to bottom of mud ring.....	F, 64 1/2 in.; B, 63 in.
Water spaces, sides, back and front of firebox.....	{ Sides 3 in.; back 4 in.; front 4 in.
Material of outside shell of firebox.....	Steel
Thickness of plates of outside shell of firebox.....	3/8 in.
Material of inside of firebox.....	Steel
Thickness of plates in sides, back end and crown of firebox.....	3/8 in.
Material of firebox tube sheet.....	Steel
Material of smokebox tube sheet.....	Steel
Thickness of front and back tube plates.....	1 1/2 in.
Crownplate is stayed with.....	Radial stays 1 1/2 in. diam.
Diameter and height of dome.....	31 1/2 x 20 1/2 in.
Working steam pressure per square inch.....	180 lbs.
Kind of grate.....	Rocking and drop
Width of bars.....	3 1/2 in.
Grate surface.....	24.77 sq. ft.
Heating surface in firebox.....	128.23 sq. ft.
Heating surface of tubes.....	1,319.90 sq. ft.
Total heating surface.....	1,448.13 sq. ft.
Kind of blast nozzle.....	Single
Diameter of blast nozzles (three sizes provided).....	4 1/2, 4 3/4, 5 in.
Smallest inside diameter of smokestack.....	18 in.
Height from top of rail to top of smokestack.....	14 ft. 4 1/2 in.
Smokebox.....	Extended, with netting and deflecting plates
Tender.	
Weight empty (actual).....	33,200 lbs.
Weight with fuel and water, full.....	75,482 lbs.
Number of wheels.....	Eight
Diameter of wheels.....	36 1/2 in.
Journals of axles.....	4 1/2 x 8 in.
Total wheel base.....	16 ft. 2 in.
Distance from c. to c. of truck wheels.....	5 ft. 6 in.
Water capacity (in gallons of 231 cubic in.).....	3,600 galls.
Fuel capacity.....	6.8 tons.
Engine and Tender.	
Total wheel base.....	50 ft. 8 1/2 in.
Total length over all.....	63 ft. 4 1/2 in.

Special mention is made of the following materials and appliances used in the construction of this locomotive:

Boiler and firebox steel, Wellman Iron & Steel Co., Thurlow, Pa.  
Tubes..... Reading Iron Co., Reading, Pa.  
Tires..... Standard Steel Works, Philadelphia, Pa.

Wrought iron wheels (Vauclain pattern), Standard Steel Works, Philadelphia, Pa.

Metallic packing, United States Metallic Packing Co., Philadelphia, Pa.  
Sight feed-lubricator, Detroit Lubricator Co., Detroit, Mich.  
Injectors, William Sellers & Co., Philadelphia, Pa.  
Safety valves, Coale Muffler & Safety Valve Co., Baltimore, Md.

Headlight, Adams & Westlake Mfg. Co., Chicago, Ill.

Brakes: (driving and trailing-wheel brake), Am. Brake Co., St. Louis, Mo.

(tender and train brake) Westinghouse Air Brake Co., Pittsburgh, Pa.

Tender brakebeams, National Hollow Brake Beam Co., Chicago, Ill.

Magnesia sectional lagging, Macan & Co., Philadelphia, Pa.

Reducing valve for steam heating, Mason Regulator Co., Boston, Mass.

Tender coupler (Janney), McConway & Torley Co., Pittsburgh, Pa.

## The Johnson Signals in the Fourth Avenue Tunnel, New York.

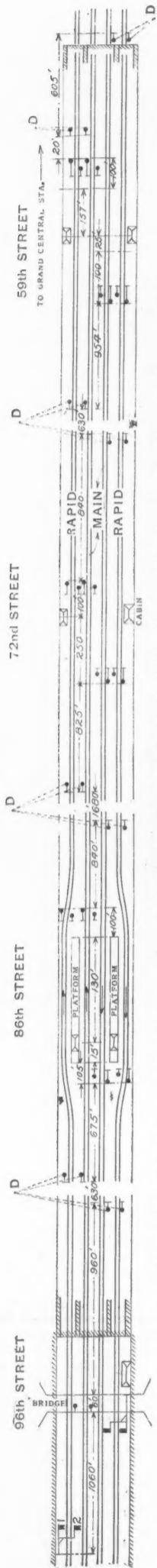
BY ARTHUR H. JOHNSON.

Every one will remember that one immediate result of the terrible loss of life caused by the collision at Fifty-ninth street, in the Fourth Avenue tunnel,\* two years ago, was to cast suspicion in some quarters upon the trustworthiness of the block signals then in use in the tunnel. For the benefit of those who are not conversant with this tunnel, or rather triple tunnel, I may say that it is about two miles long, and its south end is a stone's throw from the northernmost switches of the Grand Central yard, New York. The conditions of smoke and steam, of intermittent daylight and darkness, and of fog in damp weather hamper the enginemen in their view of signals about as seriously as one could possibly imagine. The importance of the traffic through this tunnel will be realized when it is understood that this comprises all the passenger trains of the New York, New Haven & Hartford and the New York Central & Hudson River, including the Harlem division of the latter. Five hundred trains or engines in 24 hours is a frequent record. On reference to Fig. 1 it will be seen that the two outside tunnels each contain one track. These are known as "rapid transit" tracks, and are used chiefly for local trains. The middle tunnel contains two tracks, known as main tracks. It will be noticed that trains run on the left hand tracks, as indicated by the arrows. Both the Central and the New Haven are right hand roads, and they run left-handed into New York simply because the arrangement of the Grand Central station demands it. The old arrangement of signal cabins and signals was much the same as the new, shown by fig. 1, except that only one set of cabins existed, namely, those on the east side, and only one set of signals, those on the fireman's side. The block stations are located at Fifty-ninth street, south of the tunnel, Fifty-ninth street, Seventy-second street, Eighty-sixth street and Ninety-sixth street; thus dividing each track into four block sections, or 16 sections in all. To overcome the difficulty in seeing tail-markers of trains, track circuit sections were formed to coincide approximately with the block sections, and the complete clearance of any block section by all the wheels of a train was, and is now, indicated by miniature targets in the cabin, operated by these track circuits. The block instrument formerly used was a modified form of the Sykes lock and block, designed and made by the Union Switch & Signal Company. The jury at the inquest on the bodies of those who were killed in the collision, after making an examination of the signaling appliances, placed the blame on the enginemen of the rear train, although they called attention to the apertures found in the block instrument cases, whereby the signal levers could readily be released by inserting a lead pencil.

Probably the worst effect of this accident, from the railroad standpoint, was the loss of confidence produced among the vast number of passengers passing daily through the tunnel, and the railroad officers determined to replace the signaling by thoroughly reliable apparatus. With this end in view, Mr. C. H. Platt, then General Manager of this portion of the road, formulated a number of requirements in connection with the resignaling. These requirements were drawn up by Mr. Platt after a very thorough investigation of all known signal systems, and after repeated consultation with signal experts conversant with the difficulties to be overcome. These requirements were printed in the *Railroad Gazette* of Aug. 21, 1891, and April 14, 1893. The form of block working required was the Sykes lock and block. Two signal cabins were required at each block station, one for the two northbound tracks and the other for the two southbound. Home signals must, when at danger, give audible warning both by torpedo and gong in case of an over-run. New and improved block signals with more powerful lights must be used on both sides of each track, so as to afford signals for both enginemen and firemen. All signals were to go automatically to danger on the passage of a train or engine, and repeaters were to be furnished in the cabins to show both visually and audibly if signals should by accident fail to correspond with the position of the operating levers, or if the light should fail. (The signals in the tunnel, although not always in darkness, are discs, not semaphores; that is, the daylight indications are given by the red, white or green surface of the side of the lamp, which turns on a vertical iron rod.)

But the most unique requirement was that each home signal should have a green, as well as red and white

\* Fourth Avenue is now called Park Avenue north of Thirty-third street.



TRACKS AND SIGNALS IN THE FOURTH AVENUE TUNNEL—NEW YORK CITY, NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

The left of the drawing is north, the right south. Distant signals are indicated by D. Those at the extreme right, on the southbound tracks, belong to the Fifth Avenue street car line. The distances between stations are indicated by the figures, where the lines are broken, showing the number of feet from the south signal at one station to the north signal at the next.



Fig. 2.—Interior of Signal Cabin at Fifty-Ninth Street, Fourth Avenue Tunnel.

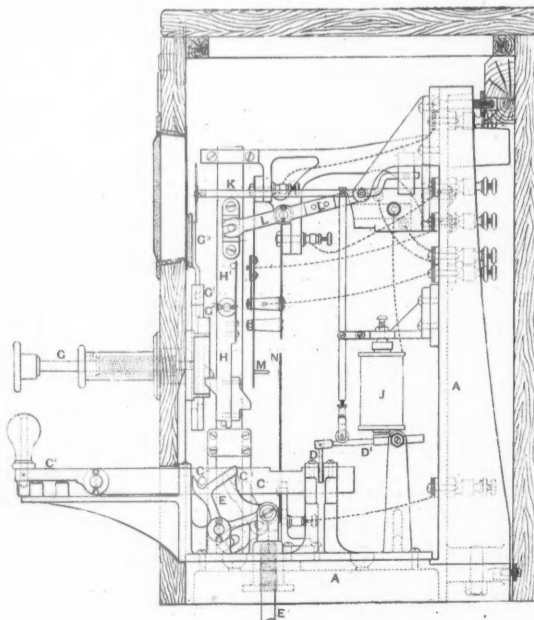


Fig. 4.

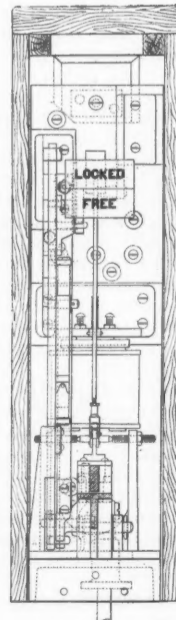


Fig. 5.

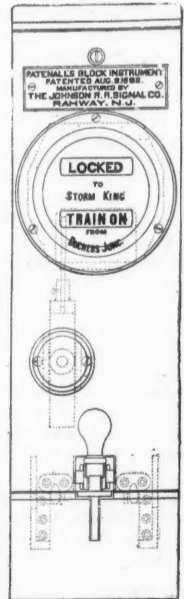


Fig. 6.

Patenall's Lock and Block Signal Apparatus.  
Made by the Johnson Railroad Signal Company.

lenses, which green lens was to be displayed by the movement of a separate operating lever, released by a separate Sykes instrument, connected to a separate instrument in the advance cabin, over its own line wires, and by its own separate battery, when by accident a failure to release had taken place on the regular set of instruments. This auxiliary set of instruments and the three-position signals were considered necessary to avoid the loss of time, and danger, connected with the issuance of a clearance card to an engineman by a signalman in such a bad place as this tunnel.

It remained for the Johnson Railroad Signal Company to construct all these safeguards in a reliable and simple manner; and in mentioning the successful carrying out of this, the most onerous block-signaling task in the world, I will take occasion to gratefully acknowledge the encouragement and support which we have received from the various railroad officers concerned. I wish also at this time to mention the devotion to duty evinced by our own men, several of whom lost their lives in this work.

Fig. 2, taken from a photograph of the interior of one of the signal cabins at Fifty-ninth street, shows the general arrangement of levers and the double Sykes instrument. The repeaters will be seen behind and above the Sykes instruments. This photograph was taken by flash light. The signalman stands with thumb on the plunger, to show how the machine is operated, but it should be noted that the plunger is locked, as the signal lever at Seventy-second street has been released by a plunge; and, as will be seen from the engraving, Fifty-ninth street has released the southbound rapid transit signal lever at this cabin, and both home and distant levers are reversed. Fig. 3 shows a plan and elevation of the arrangement of home signals for one track at one station. A is a high pot signal on the fireman's side. (On the main tracks all the signals on the fireman's side are about 12 ft. high, and all on the engineman's side are very low, being between the two tracks.) The lamp is specially constructed of heavy steel, and has corrugated lenses 8 in. in diameter; and there is a powerful circular Belgian burner with chimney and reflector. By the use of a plano-convex lens, the low signal B throws quite as strong a light as the high signal, though it has the common flat wick and no chimney. The side of a signal cannot be seen from a passing train as the light is covered by hinged wrought iron guards, C C. These also cover the back. The weighted levers D D and E E are so arranged as to return the signals to danger in case of the failure of connections, either from the white or the green positions. The quadrant and pinion F operate the torpedo machine H and the detector bar G. They are so constructed as to throw the detector bar 44 ft. long, when the signals are turned to either white or green. The detector bar is provided so as to prevent bringing the torpedo machine into gear with the wheels of a train, by mistake; at the same time the T crank cam movement J enables the home signals to be forced to the danger position at any time. K is the automatic slot, introduced into the connection, as shown; by means of a track lever, operating an electromagnet, this automatically places the signals at danger when the track lever is moved, by the passage of a train, and failing that by accident they are forced to danger by the signal lever. The cut shows the slot as I originally designed it, but some modifications have been found necessary in the magnet parts not shown. The rod L, carried by anti-friction carriers, extends to the red and green home levers, where it is so connected to both those levers as to be pushed from its normal position by the reversal of the red home lever, the one ordinarily used, and pulled from that position by the reversal of the green home (emergency) lever. The repeater contacts are not shown.

Fig. 4 is a side elevation, with part of case removed, and Fig. 5 is a sectional front elevation of the modified Sykes block instrument, designed by Mr. Patenall, Electrical Engineer of the Johnson Company, to meet Mr. Platt's requirements. Fig. 6 is a front elevation of the instrument and case. Referring to the block instrument, Fig. 4, A is an iron frame with planed surfaces, on which are fitted the various working parts of the instrument. C is a steel slide, adapted to engage with a small steel lock D, hung from one end of the armature lever D<sup>1</sup>. The drawing shows the slide C, drawn out to its full extent, with the hand latch C<sup>1</sup> down, so as to hold it in that position. The pin C<sup>2</sup> has engaged with the escapement crank E, and has lifted the rod E<sup>1</sup> so as to unlock the regular signal lever latch by freeing the tappet in the interlocking frame; and the signal lever is free to be reversed to forward a train (which is on the way from the rear cabin) to the next cabin in advance, which we will suppose to be Storm King.<sup>†</sup> The plunger G has been pushed in to unlock the signal lever in the rear cabin, which is Dutchess Junction, allowing the operator there to send on the train in question. The act of plunging and completing the electric circuit to Dutchess Junction, by bringing contact points M and N together has caused the lock slides G<sup>1</sup> and G<sup>2</sup> to drop in front of the plunger as it was sprung back, and prevent a second plunge. The indicator card G<sup>3</sup> is also lowered, so as to present the words "TRAIN ON" at the lower

<sup>†</sup> The torpedo machine was illustrated in the *Railroad Gazette*, Feb. 24 last.  
<sup>‡</sup> These instruments are used at the cabins between Yonkers and Poughkeepsie.

opening (see fig. 6). The act of pulling out the slide C causes the spring pawl H to engage with aforesaid lock slides G<sup>1</sup> and G<sup>2</sup>, and when the slide C is pushed back these lock slides will be raised to their normal position, and thus free the plunger. This is accomplished by a bell crank connection between the vertical slide H<sup>1</sup> and the slide C, through the medium of the pin C<sup>3</sup>, carried by the horizontal slide. The slide C cannot be pushed in to restore the plunging parts until the train has passed the home signal and over a track circuit, which actuates a relay, lifting the lock D, by means of the magnet J. The balanced indicating lever K will be lifted at the same time, and the word "FREE" will appear before the upper opening; then, providing the signal lever has been placed in the danger position, the slide C can be pushed back, thus dropping E<sup>1</sup> and locking the signal lever. Simultaneously both line and local circuits of the magnet J are broken by the switch L, the left hand end of which is lifted by H<sup>1</sup>, and the lock D drops into the front notch of the slide C. This will lock the slide, and cause the indicator to read "LOCKED TO STORM KING." It will be seen that the circuit through magnet J is normally open, so that the signalman in advance cannot unlock the slide, unless the signalman at this station is ready. The track circuit relay is so connected to magnet J as to prevent slide C from being pushed back until all wheels have passed off the block section, thus keeping the plunger locked during such time as the section is occupied. The vertical rods and other parts that have to be lifted are made of aluminum.

In Mr. Patenall's design the principal modification of Mr. Sykes' instrument consists in the interposition of the slide C, whereby the signal lever is directly unlocked, and in the use of the switch for keeping all metallic connections with the electromagnet normally broken, and putting the same in circuit with the line or local relays at the proper time. This enables us to operate the signal for shifting purposes as many times as we choose, provided that we leave the slide C pulled out. In Mr. Sykes' design the signal lever is directly unlocked by a plunge from the advance signal station, and it is immediately relocked at danger upon its return to that position after having been reversed.

The indicator for apprising the signalmen of the condition of the lights is a disc attached to the armature of

variations of condensation can be ascertained. One who approaches this subject for the first time will be astonished at the results. Improvements in the utilization of steam must be directed toward the diminution of initial condensation, which in some cases amounts to 50 per cent. of all the steam used. All practicable efforts to prevent or greatly diminish cylinder condensation have failed. Condensation in small cylinders has been prevented by means of gas flames playing upon them, but this is evidently out of the range of practicability. Nothing short of a sufficient supply of heat to keep the temperature of the walls fully up to the temperature of saturated steam of the pressure carried can be successful in preventing initial condensation as long as iron cylinders are used. Steam jackets, while they are known to be a means of economy, can only be considered as a partial means. In order to prevent the enormous initial condensation that occurs, jackets should be nearly as great evaporators as the boilers themselves. A jacket in itself is a source of waste, for it increases the external radiating surface of the cylinder, and is itself hotter than a similar unjacketed cylinder. Moreover, when exhaust occurs, heat is carried from the jacket out of the cylinder. This loss of heat is known as "exhaust waste," and in single cylinder engines or in the last cylinder of a multiple expansion engine cannot be recovered. In a compound or triple expansion engine any exhaust waste from the first cylinder is utilized in the others, and in general, in a multiple expansion engine, any exhaust waste is utilized except that in the last cylinder. The reason, then, why jackets are, on the whole, sources of economy is that they are to some extent carriers of heat from the boiler to the working steam, and thus do somewhat diminish condensation. The jacket should, of course, drain into the boiler, and when this is the case it is easy to see that each particle of steam supplied to the jacket is a messenger of heat which, by condensation, it supplies to the cylinder walls and thus to the working steam. When condensed it flows back to the boiler, becomes charged with more heat, and returns to the jacket again to deliver its heat to the working fluid. It follows from this that the greater

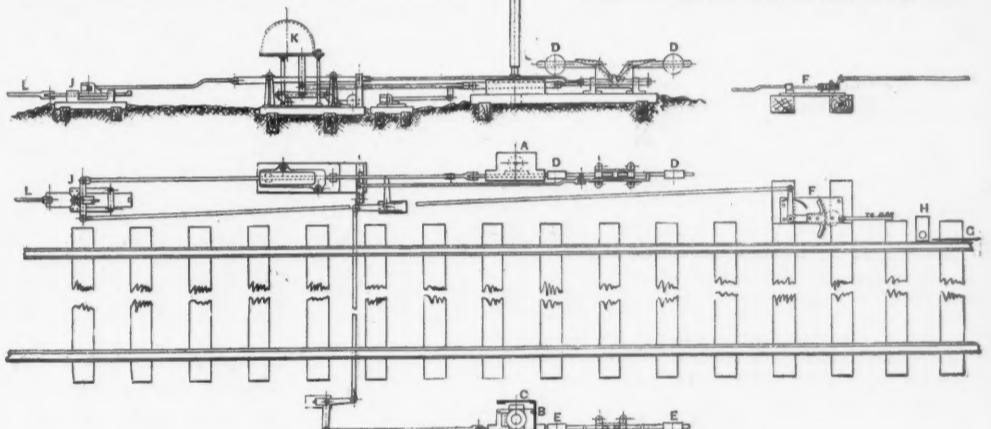


Fig. 3—Three-Position Home Signals, Fourth Avenue Tunnel.

an electromagnet. This magnet is energized, when the corresponding signal light is burning, by a make and break movement at the lamp, obtained by the curvature of zinc and copper strips riveted together, which expand unequally by the heat of the flame, owing to the great difference in the coefficients of expansion of the two metals. If the flame dies out, these two strips rapidly straighten out and break the circuit, causing the light indicator to show "LIGHT OUT." An audible alarm is also given.

All line wires are carried in cables especially packed to suit the tunnel. Under the excellent system of maintenance instituted by the present General Manager, Mr. J. H. Franklin, the whole apparatus has worked perfectly for some time. It is very improbable that another rear collision will occur in the Fourth Avenue Tunnel, while the present signal appliances are kept in their present condition.

#### Behavior of Steam in Cylinders of Engines.\*

One of the greatest obstacles in the way of improving the steam engine is the difficulty in understanding the behavior of the steam within the cylinder. This is caused largely by the obscurity of the action of the walls of the cylinder. It is now well understood that often an astonishing amount of the steam that enters a cylinder is condensed before any work is done. Before the piston can be moved, it and the cylinder must be heated to the temperature of the steam, and this can only be accomplished by condensation of the entering steam, which thus gives up its heat. This has been so often investigated with great care that there can be no doubt about it. By carefully studying diagrams made by accurate indicators, and ascertaining the quantity of steam entering the cylinder, the amount and

the condensation of jacket steam and the more rapid the circulation, the more efficient the jacket is. It is sometimes difficult to secure circulation, and in order to avoid this difficulty jackets are often made the passages of the steam to the cylinder. While this construction secures circulation, it is obviously less efficient than a well circulating independent jacket supply, as in the former the working steam must be nearer the condensing point when it enters the cylinder. The efficiency of jackets is well established, and conditions must be unusual to render them useless. Their efficiency may be low whenever superheated steam is used, and in many cases jackets are doubtless full of water, which renders them worse than useless. Difficulties of this kind are common at sea, and jackets have consequently been omitted on the White Star steamers "Teutonic" and "Majestic."

The condensation thus far mentioned is that which occurs before the cut-off, and is called initial condensation. It is due to fresh steam coming in contact with clearance, cylinder and piston surfaces which have just before been in contact with exhaust steam, which is of low pressure and temperature. This could be prevented not only by heating the walls artificially, as previously mentioned, but by making the cylinder of non-conducting material. Glass, lead, and certain enamels would approximately serve, if durable. Condensation, however, does not cease after cut-off, for steam condenses as it expands. This is shown both experimentally and mathematically—the former by using a glass cylinder, in which, shortly after expansion begins, the steam becomes foggy. It should not be assumed, however, that all vapors become foggy when expanding. Ether is an example of a vapor which does not. The difficulty with saturated steam is that it is always ready to condense from the slightest cause, and condensation during expansion can only be prevented, or partially so, by

\* Extracts from a paper by Mr. F. W. Dean, Mechanical Engineer; written for the Chapman Valve Manufacturing Company's Catalogue, edition of 1892.

\* The steam parts with the heat-equivalent of the work done, and therefore condenses.

using steam which is so highly superheated that it will only reach the condition of saturation at the end of expansion. This, however, is impracticable.

When initial condensation occurs, the metal of the cylinder stores up heat. When expansion begins, the pressure and temperature of the steam fall, and water in the cylinder begins to be evaporated by the heat stored up in the cylinder walls, which now begins to flow out. This evaporation increases as expansion continues and as exhaust goes on. When the exhaust valve closes early enough to produce compression, the walls are somewhat heated as the steam is compressed.

The diagrams of expansion hitherto drawn have followed a curve called the hyperbola, or curve of equal temperatures. As far as an investigation for determining the amount of work that can be done in a cylinder is concerned, this curve answers well. In most cases actual indicator diagrams from cylinders nearly coincide with the hyperbola, but it should not be assumed from this that the law of expansion of steam is ever shown by that curve. As the steam expands, the curve tends to fall below the hyperbola, but as re-evaporation occurs the additional steam thus supplied increases the pressure, and thus the curve rises. But no part of the steam expands hyperbolically.

There is another curve that is sometimes useful in investigating the expansion of steam, viz., the "adiabatic" curve. It supposes the expanding steam to receive or lose no heat from or to an external body. This, of course, could only be the case in a non-conducting cylinder. As steam and water are bad conductors of heat, it is probable that the steam in or near the middle of the cylinder expands adiabatically.

Still another curve of expansion is the so-called "curve of saturation." It assumes that the steam is always dry and saturated, and by its use one can judge of the change in the amount of water in the steam as the expansion goes on. This curve can be constructed by laying off pressures vertically and the corresponding volumes as found in tables of the properties of saturated steam. If, on an actual indicator diagram, a curve of saturation be drawn through the point of cut-off, the horizontal distance between two points on the curves at the same level shows the amount of steam that has condensed, and the corresponding amount of water will be found in the cylinder, provided the actual diagram is within the saturation curve. If it is outside, the difference in volume denotes superheating. On the other hand, for any two points on the curve at the same volume, the difference in pressures is that due to condensation or superheating, according as the actual curve is within or without the saturation curve.

Initial condensation is produced to some extent by the amount of water which lies in the clearance spaces after exhaust. This water is variable in amount, and has a variable effect. In one instance the condensation was greatly diminished by circulating steam through a small pipe lying in the clearance space of the engine.

An apparently trifling difference in the law of expansion makes a great difference in the heat needful to produce it; and conversely a great change in the heat supply makes but little difference in the law of expansion. Consequently nearly all indicator diagrams look alike unless they are drawn by good instruments and carefully examined.

#### Indicator Diagrams from the C., C. & St. L. Class "Y" Locomotive.

Illustrations and description of the class "Y" locomotive of the Cleveland, Cincinnati, Chicago & St. Louis were given in the *Railroad Gazette* of April 14, and May 5 and to-day. One of the features of this class, as pointed out, is the length of the ports. As stated in the description, the steam ports are 23 in. long and 1 1/4 in. wide, and the exhaust ports are the same length and 2 1/4 in. wide. The table of cut-offs and leads given with the article shows how nearly constant the lead is. This was obtained by setting the back gear eccentric so that there was a negative lead in back gear; that is, in back motion the valve was given no lead, and in fact does not open until the crank has passed the dead centre. Owing to the length of the steam and exhaust ports, the indicator diagrams shown with this will be interesting.

The following table gives the data referring to each diagram:

Card No.	Boiler press.	Cut-off, inches.	Throttle opening.	Back press.	Speed, miles an hour.	Opposing grade, feet.	Mean effective Pressure.	
							Head end.	Crank end.
1	160	12 3/4	.4	6	23	39.6	95.5	96.0
2	170	12 3/4	.4	5	23	39.6	101.0	100.5
3	175	10 3/4	.4	5	25	30.0	93.0	92.5
4	165	6 3/4	.4	9	39	11.5	63.2	62.5
5	165	6 3/4	Full	9	39	11.5	61.0	62.7
6	165	6 3/4	Full	9	39	11.5	55.2	55.5
7	165	6 3/4	.33	9	42	0.0	53.5	55.2
8	165	6 3/4	.33	9	47	0.0	66.2	66.0
9	170	7 3/4	.33	7	36	5.8	62.2	63.0
10	180	5 3/4	Full	9	41	5.8	63.2	64.0
11	180	6 3/4	Full	15	50	19.0	56.5	55.0
12	180	6 3/4	.33	10	50	19.0	58.7	58.0
13	180	6 3/4	.33	9	39	19.0	67.7	68.5
14	180	6 3/4	Full	12	39	19.0	64.5	65.0
15	180	6 3/4	.4	10	37	19.0	63.2	63.5
16	190	6 3/4	.4	11	39	13.5	66.2	65.7
17	180	6 3/4	.4	10	40	13.9	59.5	59.5
18	173	6 3/4	.4	10	38	0.0	80.2	81.0
19	175	7 3/4	.4	8	38	24.1	38.5	37.5
20	155	5 3/4	.4	10	60	14.0		

The class "Y" locomotive was designed to haul the heavy passenger trains on the Columbus Division. These trains were previously hauled by the Class "N" locomotives; but as they could hardly make schedule time on this division, the Class "Y" was designed, and the desired object has been attained; viz., the new locomotives out, can make the schedule time with 10 to 12 cars, and they often make up several minutes when necessary. That the two classes may be easily compared, the following table of some of the principal dimensions is given:

Type.	Class "N," 6 Coupled Drivers.	Class "Y," 4 Coupled Drivers.
Diameter of cylinders.....	18 1/2 in.	18 1/2 in.
Length of stroke.....	24 in.	24 in.
Driving wheels, diameter....	68 in.	68 in.
Wheel base, rigid.....	15 ft. 6 in.	7 ft. 9 in.
Wheel base, total.....	25 ft. 6 in.	22 ft. 8 1/2 in.
Weight on driving wheels....	106,500 lbs.	86,500 lbs.
Weight on truck.....	22,900 lbs.	42,780 lbs.
Weight, total.....	129,400 lbs.	129,280 lbs.
Tubes, number.....	232	241
Tubes, length.....	13 ft. 10 1/4 in.	11 ft. 4 in.
Tubes, outside diameter.....	2 in.	2 in.
Firebox, size.....	41 3/4 x 101 3/8 in.	41 3/4 x 108 1/8 in.
Grate surface.....	29.17 sq. ft.	31.3 sq. ft.
Heating surface, tubes.....	1,667 sq. ft.	1,426.26 sq. ft.
Heating surface, firebox.....	140.6 sq. ft.	147.74 sq. ft.
Heating surface, total.....	1,807.6 sq. ft.	1,574.02 sq. ft.
Diameter of boiler (smallest ring).....	66 in.	60 in.

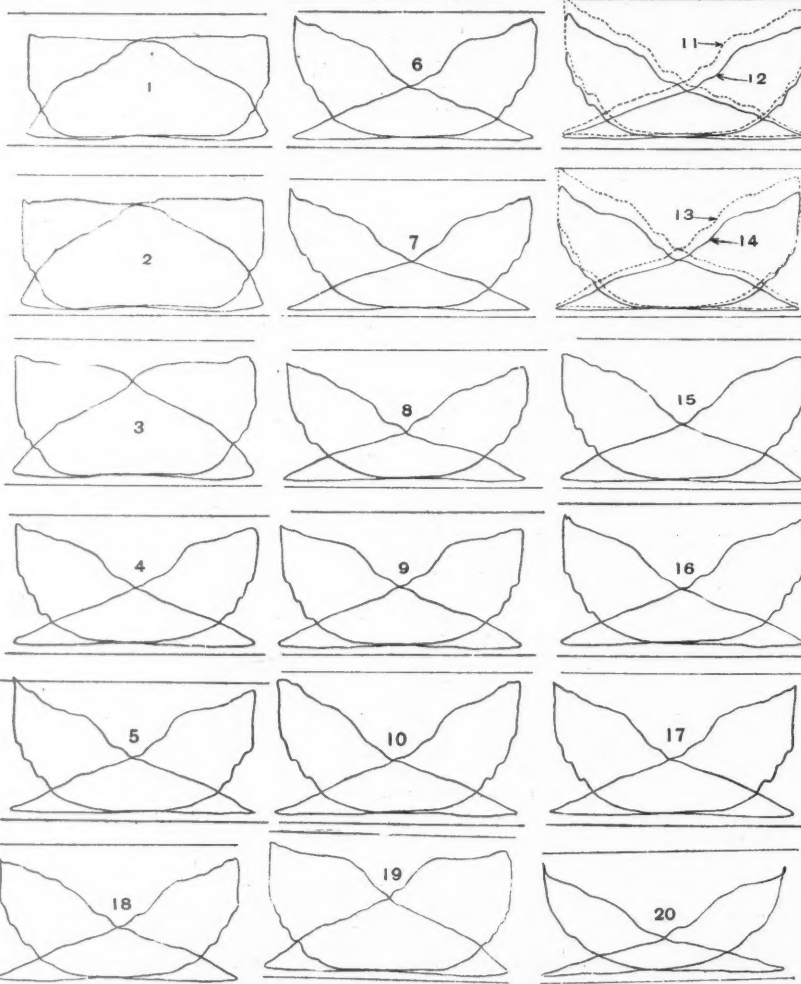
The diagrams given with this show the distribution of steam when running at various speeds from 23 to 60 miles an hour. Diagrams 1 to 18 inclusive were taken

effective pressure when the throttle is only partly open, card No. 20, taken at a speed of 60 miles an hour, does not show the advantage, at high speeds, the long port has over the short port. Card No. 20 was taken when the locomotive was hauling a light train; the cut-off was as short as was best to make it, being less than one-fourth of the stroke, and the power of the engine had to be regulated with the throttle. Had the train been heavier and the throttle opened full the advantage of the long ports would have been obtained and the mean effective pressure would have been much greater.

#### Long Spans and High Piers.

Mr. M. McCabe, of Pontiac, Ill., sends us some facts concerning the construction of four piers of a railroad bridge built in 1879. Three spans of this bridge are "through spans 320 ft. long. The four piers for these three spans were ordered to be raised 50 ft. above high water, so as to allow steamboats to pass under the bridge. The piers below high water are from 30 to 50 ft. The four high piers were built solid to high water line and are only 12 ft. wide at that line; then to save masonry the engineer built two towers on each pier, the base of each tower being 1 1/2 ft. square; the top being 7 1/2 ft. square, 50 ft. above the base. "The towers and the piers vibrate down to low-water line, a height of about 70 ft."

A consideration of these facts has drawn from Mr.



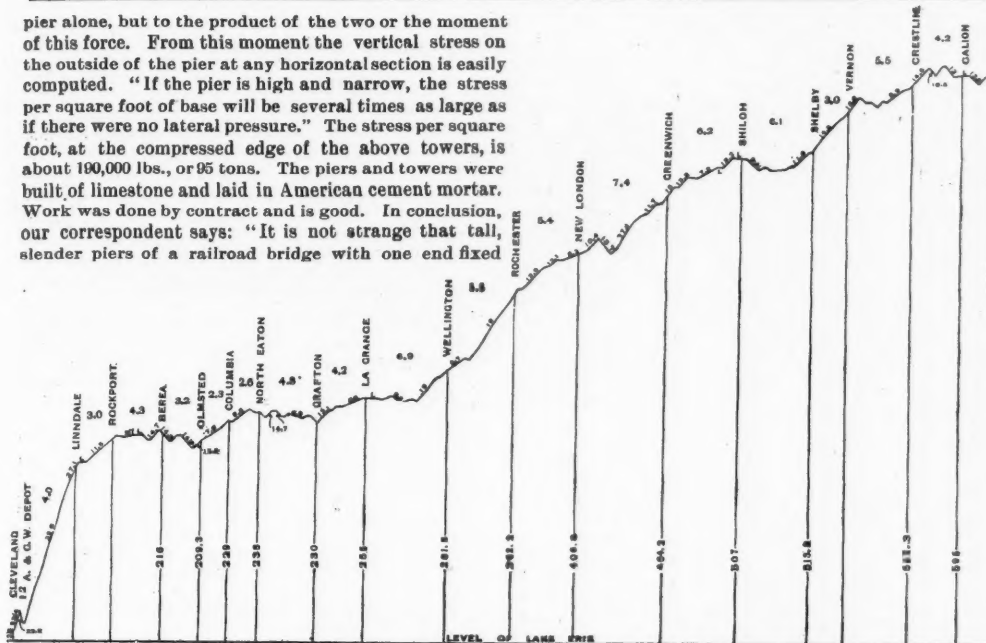
Indicator Diagrams, Class "Y" Engine—C., C. & St. L. Railway.

from locomotive No. 205 while hauling 10 cars between Cleveland and Galion. Diagrams 19 and 20 were taken between Galion and Columbus from the same engine on the same date, but five cars had been cut off at Galion, leaving five cars on the train. The wavy expansion and compression lines are probably due to some vibration or momentum of the reducing motion. There is a step, however, in the compression line due probably to the preliminary port in the valve. The expansion line indicates a leak from the steam side of the valve to the preliminary passage, probably at the under face of the valve. The profile of a part of the division over which the diagrams were taken also accompanies this article.

It is to be regretted that all the diagrams were not taken with the throttle full open. Diagrams 11 and 12 and 13 and 14 show clearly the effect on the mean effective pressure of running with a partially open throttle. At a speed of 50 miles an hour, 6 3/4 in. cut-off and 180 lbs. boiler pressure in each case, the mean effective pressure was 55.75, a average of both ends of the cylinder, with the throttle one-third open, while with the throttle full open the average mean effective pressure was 63.5; the average back pressure was 10 and 13 lbs. respectively; so that while the back pressure also increased with the full opening of the throttle, it did not increase in nearly the same ratio as the mean effective pressure. Cards 13 and 14 show also a decided increase in mean effective pressure with a full throttle and a slight increase in the back pressure. On account of this decrease in mean

McCabe a brief discussion of some of the conditions tending to weaken and destroy high piers in general, and he points out that friction rollers under one end of a span relieve only the pier upon which they are placed. This discussion continues in the main somewhat as follows: Under a live load the top chord of a span contracts while the bottom expands. The longer the span and the heavier the load, so much the more will this contraction and expansion be. If both ends of the span were fixed, this force of expansion in the bottom chord would be exerted laterally against each pier equally, and the ease with which it would impart motion to the piers would depend upon their height; that is, the distance of the point of application of this force from the bases of the piers. If, again, both ends of the span were on rollers and free to move, the force of expansion would be resisted by friction only. When, however, one end of the span is fixed and the other is on rollers, the force of expansion of the bottom chord under live load can expend itself in one direction only, and as a result the centre of gravity of the whole span and its load is shifted in that direction. To move the centre of gravity, the inertia of the system, as well as the comparatively small resistance due to friction, must be overcome. The very considerable force which is at work moving this centre of gravity must have its reaction in the pier at the fixed end of the span, and, as our correspondent points out, the amount of vibration of this pier under full load will be proportional, not to the force alone, nor to the height of the

pier alone, but to the product of the two or the moment of this force. From this moment the vertical stress on the outside of the pier at any horizontal section is easily computed. "If the pier is high and narrow, the stress per square foot of base will be several times as large as if there were no lateral pressure." The stress per square foot, at the compressed edge of the above towers, is about 100,000 lbs., or 95 tons. The piers and towers were built of limestone and laid in American cement mortar. Work was done by contract and is good. In conclusion, our correspondent says: "It is not strange that tall, slender piers of a railroad bridge with one end fixed



Profile to Accompany Indicator Diagrams, Class "Y" Locomotive.

should be in a continual state of vibration by the expansion and contraction of bottom chords, by changes of temperature and the passage of heavy trains, thereby endangering the safety of piers and bridge."

#### Watson & Stewart's Automatic Block Signal System for Tunnels.

At Weehawken, N. J., last Tuesday an exhibition was given of a novel arrangement of incandescent electric lights for blocking trains a certain minimum distance apart while running through the tunnel of the West Shore Railroad at that place, which is 4,200 ft. long. This arrangement of signals was devised by W. G. Watson, Division Superintendent, and Joseph B. Stewart, Superintendent of Telegraph and Signals of the West Shore, and patents have been granted to them.

The main feature of the system is a line of incandescent electric lamps placed along the track about on a

This is all done automatically by the train passing over track circuits, all the parts of which are very simple and can be understood and maintained by any ordinary telegraph lineman. The system is so arranged at Weehawken that the electric light circuits pass through the signal tower, where the old semaphores are worked from, and a lamp connected with each circuit in the tunnel is displayed, so that the operator can tell at a glance the whereabouts in the tunnel of a train. By opening a small switch he can put out the lamps in any section and stop any train; or he can put out all lamps and stop all trains. This system not only doubles the capacity of the tunnel and provides for the control of trains anywhere in it, but gives to the engineer, conductor and trainmen a constantly visible signal for the movement of the train. It will not be necessary for the engineer to reduce speed when approaching the end of a block section, expecting there to find the signal against him, as the dark section of 1,200 ft., or more, gives ample space to stop. In other words, the dark section acts as a continuous caution or distant signal extending from the point where the engineman discovers it to the entrance of the next section.

The conditions of signaling in a tunnel, more difficult



Arrangement of Experimental Signals on Westbound Track in Weehawken Tunnel—West Shore Railroad.

P, east portal of tunnel; A, beginning of line of electric signals; B, end of first track circuit; C, end of second track circuit, 1,200 ft. from portal; D, end of third track circuit, 2,300 ft. from portal. The figures below the line show the distances in feet from A to B, B to C, and so on.

level with the eyes of the engineer, as close together as desired (in the Weehawken tunnel they are placed about 100 ft. apart). The lamps are normally lighted, which condition indicates safety and a clear track. The principle of operation is *Proceed* when the lamps are lighted; *Stop* when the lamps are not burning. A train, by its movement, controls the lights by means of an electric circuit flowing through the rails of the track.

The method on which the lamps are arranged and operated is shown by the accompanying diagram, representing a section of track. A train running from C to D finds an electric (white) light every 100 ft., indicating that the road from D to E is clear. As the train passes D the relay in the track circuit which extends from D to E is opened (and remains open as long as any part of the train is on the rails between D and E), and thereby opens the lamp circuit between C and D, extinguishing the lights and producing a danger signal—darkness—in that section, protecting the train. At the same time this relay closes the lamp circuit extending from A to C (which before was open) and relights the lamps, thus permitting a following train to proceed as far as C. The arrangement of lamps at Weehawken is further explained by the inventors as follows:

"While this system is applicable to any part of a railroad, the automatic device, which has been successfully tested, is especially adapted for the quick movement of trains through tunnels under conditions of absolute safety. By its use the capacity of a tunnel 3,000 ft. long, or longer, can be doubled, or still further increased in proportion to its length. The Weehawken tunnel is 4,200 ft. long, and the lamps have been placed so as to divide it into two sections (doubling its capacity for the movement of traffic as compared with the old system of a block office at either end and allowing but one train in the tunnel at a time going in one direction). A train entering the tunnel at the east portal puts out all the lamps outside of the tunnel (lamps are strung for 500 ft. outside) and for 300 ft. inside; also every alternate lamp for 900 ft. farther in the tunnel. The overlap lamps which alternate with the lamps in the first section are left lighted for the train to run by to a point 2,300 ft. inside, where the lamps in the middle section are put out, thus producing a dark section of 1,100 ft. immediately behind the train, which is maintained until the train passes out of the tunnel at the west end. At the same instant that the lamps in the middle section are put out, those in the first section of 1,200 ft. are lighted, so that when the train has reached a point 2,300 ft. in the tunnel the signal to proceed is displayed at the east end of the tunnel for a following train. When the train passes out of the tunnel at the west end, the lamps in the middle section are lighted,

than anywhere else, were widely discussed after the collision in New York City in February, 1891, and they were set forth in detail in these columns then, especially in an article on "Signaling the Tunnel," in the issue of March 13, page 183. The main feature of the system now shown at Weehawken is the same as that of a plan described in that issue of the *Railroad Gazette*, page 176, the latter being arranged for use primarily as a manual system, while Messrs. Watson and Stewart's is automatic.

Electric lights, placed a short distance apart, make an ideal arrangement of signals for a tunnel. The root difficulty in running through tunnels is in *finding the signals*; and placing them close together obviates this. By using go-ahead signals only (and depending upon the absence of all signals for the indication to stop) it is necessary to use the system as a caution system, for there is nothing to indicate any precise place to stop at; but by the use of a separate line of red lamps both stop and caution signals could be given. It is also possible, as the instruments are very simple, to divide the lamp circuits so that a train can clear 500 ft. at a time behind itself instead of keeping following trains back until it has gone far enough to make it safe to clear the whole of a long section.

#### Some World's Fair Exhibits.

##### LOCOMOTIVES AND CARS FROM FRANCE.

The long delayed exhibit of locomotives and cars from the State railroads of France arrived recently at the World's Fair grounds; it comprises four locomotives and one passenger car for suburban service. The coach is double deck, with the seats both above and below extending crosswise of the car. There is seating capacity for 100 persons, and when the steps and railings are crowded, as they are on race days, each car carries about 150 persons. This is a very large number, considering the weight of the car, which is eight tons, and the fact that it is carried on four wheels. The wheels are wrought iron, single plate with ribs, and steel tired. The brakes are applied to both sides of each wheel, the brakehoe and head being solid and attached to a wrought iron brakebeam. The underframing is of iron and wood, the side sills being of I-beams. There are no intermediate sills. The transverse beams are of wood

spaced with about 2 x 2 in. angle iron. These angles also serve to transmit the buffing strains diagonally across the framing from the corners of the car where the buffers are placed.

All of the four locomotives exhibited have been in regular service for two years or more, so it cannot be claimed that they were built specially for exhibition. One is a tank engine, with six coupled wheels, all the wheels having flange tires. As there is very little play in the boxes, much trouble was experienced in running this locomotive over the sharp curves of the American roads. Some of the more striking features are: the inside cylinders, the very light connecting rods (these are of steel with the ends fitted with solid bushes) and the small coal space. Some of the chief dimensions of this engine are as follows:

Diameter of cylinder.....	16.9 in.
Stroke.....	25.6 in.
Centre to centre of cylinders.....	25.6 in.
Length of connecting-rods (between centres).....	68.8 in.
Diameter of wheels.....	60.6 in.
Total wheel base.....	14 ft. 7.1 in.
Boiler, working pressure.....	112 lbs.
Boiler, diameter.....	48 in.
" length.....	10 ft. 2 in.
Boiler, thickness of plate.....	0.55 in.
Firebox, length.....	49.5 in.
" width.....	40.2 in.
" depth grate to crown sheet, mean.....	59.0 in.
Tubes, number.....	203
" diameter outside.....	1.77 in.
" length between tubesheets.....	10 ft. 6 in.
Blast nozzles.....	5.1 in.
Heating surface, firebox.....	81.8 sq. ft.
" tubes.....	889.2 sq. ft.
" total.....	1,071.0 sq. ft.
Grate surface.....	14.7 sq. ft.
Capacity of tank.....	880 gallons
" coal space.....	2,400 lbs.
Weight, empty.....	33.4 tons
" loaded.....	41.5 tons

Locomotives of this type have been used for some years by the Western Railroad Company for hauling local traffic on divisions having heavy grades. They are used in passenger traffic from Paris to St. Germaine, where the grade is 1 in 28.6 and on other divisions where the gradients vary from that to 1 in 100.

Another of the French engines is a tank locomotive with six coupled drivers, and in these respects is like the one above described. All the driving wheels have flange tires. This engine has two cylinders, inside connected. Like all the foreign engines, this one has very light connecting and coupling rods and crossheads, and they are all so light compared with those on the American engines exhibited that they will attract much attention from American engineers.

The locomotive from the Northern Railroad has four coupled driving-wheels and a four-wheel leading truck. The driving-wheels are 7 ft. in diameter. This is a four-cylinder compound locomotive; the two low pressure are between the frames and connected to the forward driving axle; the two high pressure cylinders are outside and are connected to the crank pins on the back driving-wheels. The connecting rods from the high pressure cylinders are 10 ft. long.

The "Patay" is another engine in this exhibit; it has four connected driving-wheels, a two-wheel leading and a two-wheel trailing truck. The trailing truck had to be removed so that the locomotive might be run over the roads from the Atlantic coast to Chicago, and on some of the others the driving axle had to be removed for the same reason. This engine is equipped with the A. Bonnetford valve gear, all the links and arms of which are outside of the frames and the eccentric is on a return crank outside of wheels.

All of these locomotives will excite the curiosity of the English and American engineers on account of the large number of parts and the complicated valve motions on some of them.

##### THE WHEEL EXHIBIT.

**Arbel Establishment.**—One of the larger exhibits of wheels of different design is that made by the Arbel establishments of France. A large assortment of wrought iron, spoked wheels of different diameters, from the largest driving wheels to the smallest truck wheels, all with steel tires and mounted on axles, is piled in a high pyramid near the centre of the Transportation Building. Besides these there are solid single plate wrought iron wheels, with steel tires, for engine trucks and cars; also light wrought iron wheels six or seven feet in diameter, with a wooden felly between the wrought iron centre and the tire. These latter are used by the ordnance departments of a number of European governments.

**Boies Steel Wheel Co.**—In the exhibit of this company are cast steel wheels mounted on axles and others with steel tires locked with retaining rings. Some of these latter have been cut in two and the sections finished so as to show the quality of the metal and the joint made with the ring. The joints are certainly very well made.

**Taylor Iron & Steel Co.**—Some of the wheels shown by this company are cast iron car wheels mounted on axles, and others are spoked wheels cast from manganese steel. One of the steel spoked wheels shown has been tested under a drop test, the wheel standing in a vertical position and the blow being received on the outer rim; 33 blows were struck, the drop falling 30 ft., and there was but a slight indentation.

**Montreal Car Wheel Co.**—This company, whose works are at Lachine, Quebec, has a small exhibit of cast iron wheels for steam surface and street car equipment.

**The Union Steel Works, Dortmund, Westphalia.**—This company has samples of cast iron and wrought iron wheels of various kinds and axles with forged cranks. The axle forgings are samples of most excellent workmanship.

**Lehigh Car Wheel & Axle Co.**—The works of this company are at Castasaga, Pa. The exhibit is composed of solid plate, cast steel wheels, and others of the same material, but with spokes. These wheels are intended for cars and engine and tender trucks.

**J. H. Bass' Foundries.**—The Chicago, Ft. Wayne and Indian-

apolis foundries, operated by J. H. Bass, each have samples of their work in the Transportation Building. These consist of cast iron car wheels and cast iron driving wheel centres, and cast steel car wheels with steel tires.

**St. Louis Car Wheel Co.**—An exhibit of cast iron wheels is made by this company. The wheels were cast in a contracting chill and have been ground on the tread.

**Standard Steel Works.**—As stated in the *Railroad Gazette* of May 19, 1893, the wheel exhibit by this company is made up of wrought iron wheels of various sizes, from the small truck wheel to the largest driving wheel. Some of the wheels are completely finished with steel tires, and others are unfinished, showing the wheel in various stages of forging. Several show the hub, spokes and rim just as they have run together in the heating and ready for the finishing blow, and others show the wheels after leaving the finishing die.

**Barnum & Richardson Company.**—Four cast iron wheels made by this company at Salisbury, Conn., add to the list of wheels shown that were cast in contracting chills.

**The Ensign Manufacturing Co. and the Canda Manufacturing Co.** exhibit together about 50 cast iron wheels, ranging in size from 20 in. to 36 in. in diameter, and intended for steam surface roads and street cars. All of these were cast in the Canda contracting chill and are ground on the tread.

**Russell Wheel & Foundry Co.**—Under a logging car exhibited by this company are cast iron wheels made in the foundry of the company at Detroit, Mich.

#### METALLIC PACKING.

In a search through the Transportation Building and Machinery Hall four kinds of metallic packing for piston and valve rods were found, two in each building. The Jerome and the United States exhibits are side by side in the Transportation Building. The Jerome Company has a steam-chest and a cylinder stuffing-box, each with a large longitudinal section removed, so as to show clearly the arrangement of the rings and other parts. The United States Co. has a large exhibit of its packing. The Tripp metallic packing is shown in the pavilion of the Hancock Inspirator Co. in Machinery Hall, and the Columbia packing is in the same building.

#### INJECTORS, LUBRICATORS AND VALVES

Most of the injectors, lubricators and valves are exhibited in Machinery Hall, but the *Coale Muffler & Safety Valve Co.*, of Baltimore, Md., has space in the Transportation Building. It has a large display of rod cups and muffler and safety valves.

**The Buckeye Iron & Brass Works**, of Dayton, O., show rod cups, whistles and water gauge cocks.

**The Hancock Inspirator Co.** has arranged a large assortment of inspirators in a pavilion near the water tank in Machinery Hall. A small tank is so arranged that it can be filled with water at any desired temperature. Injectors of various sizes are connected with this tank, the source of supply. A valve is located in the discharge pipe, and by means of this the pressure, against which the injectors work, may be varied. Thermometers are arranged to show the temperature of the water in the tank, and the temperature of the discharge. Several injectors have been sectioned longitudinally to show the arrangement of combining tubes and other inside parts.

**The Crane Co.**—This company has an exhibit of chime whistles, oil cups and other locomotive furnishings in its large exhibit of valves and other furnishings for stationary engine work.

**The Nathan Manufacturing Co.** has a very large case in Machinery Hall, in which are exhibited oil cups and sight-feed lubricators in great variety. Two lubricators, divided longitudinally, show the arrangement of the device. The different kinds of injectors made by this company are also in the exhibit, the most striking one of which is the non-lifting injector with an air chamber on the side.

**L. Schutte & Co.** show injectors of various sizes in their pavilion in machinery hall.

**The Ashton Valve Co.** shows its safety and muffler valves of various kinds in the same building.

**Hayden & Derby Manufacturing Co.** exhibit the Metropolitan injector in great variety. Several of the injectors have been sectioned to show the arrangement of the inside parts.

**The Ashcroft Manufacturing Co.**—The exhibit of gauges by this company is very extensive, and one of the largest of similar exhibits at the Exposition. This company shows also a variety of safety and muffler valves for locomotives.

**Crosby Steam Gauge & Valve Co.**—The exhibit of this company, like that of the company preceding, is composed largely of pressure gauges for various purposes, and safety and muffler valves for locomotives and stationary boilers.

**Detroit Lubricator Co.**—This company has a large double pavilion, in one part of which is a large nickel-plated frame loaded with lubricators of different design. The feature of this exhibit is the triple feed No. 4 lubricator that was designed for the locomotives hauling the Pennsylvania limited trains. This lubricator is much larger than those generally used; it holds one gallon of oil, so that even on the long runs it is not necessary to refill it. Another one shown is to lubricate the low and high pressure cylinders of a compound locomotive from one lubricator. In the other part of the pavilion is a boiler and steam engine with a Detroit lubricator attached to show the working of it.

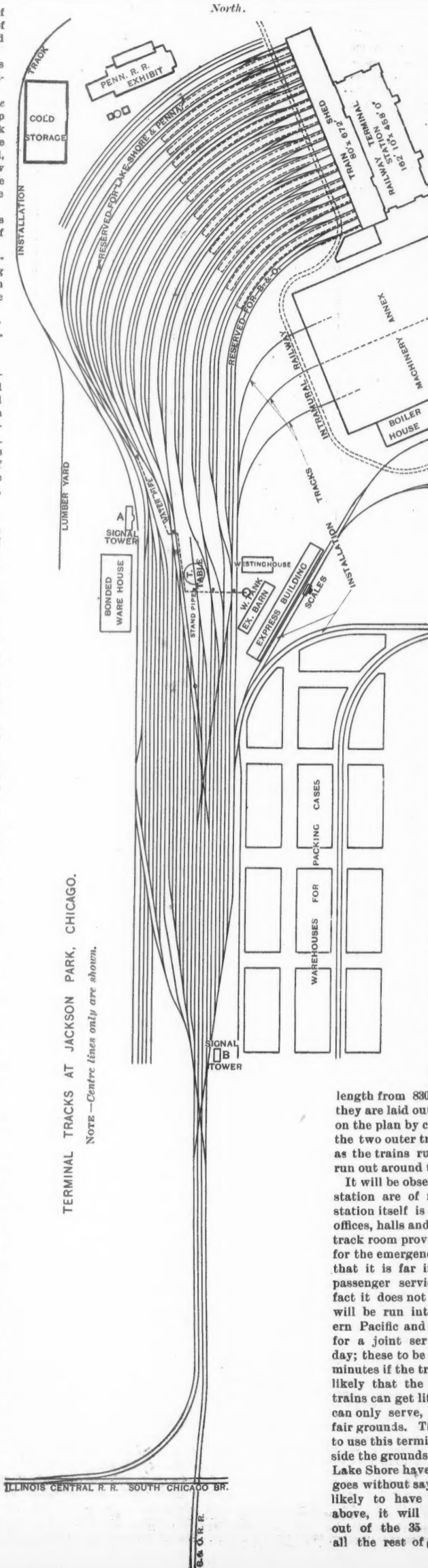
**The Lunkenheimer Co.**—The feature of this exhibit, so far as railroad officers are concerned, is the dome whistle, of which this company is making quite a specialty. There are also oil cups, grease cups and sight feed lubricators in the exhibit.

**Sidney Smith & Sons.**—Near the extreme east end of Machinery Hall, in a glass-case, is the exhibit of whistles, sight-feed lubricators and steam and water gauges made by this company. The manufacturing name of the firm is the Basford Brass Works, and the establishment is in Nottingham, England.

A new design for a lubricator is that patented by Mr. C. C. Jerome, and exhibited in the pavilion of the Jerome Metallic Packing, in the Transportation Building. It is a small force pump operated from the driving axle or reciprocating parts of an engine, and forces a spray of oil from the conducting pipe once in a certain number of revolutions of the wheel, or strokes of the reciprocating parts. It can be regulated to feed oil of any viscosity in any amount. If necessary 10 or 12 pipes may be led from the cup to the wearing surfaces that are to be lubricated.

#### VELOCIPEDES AND HAND CARS.

The exhibit of the manufacturers of velocipedes, hand cars, push cars etc., in the Transportation Department is quite



complete and very interesting. With few exceptions the various articles in these displays are well known to all railroad men interested in the care or construction of track or telegraph lines.

**The Kalamazoo Railroad Velocipede & Car Co.**—This company exhibits a full line of velocipedes, telegraph line repair cars and inspection cars, suitable for different carrying capacities and standard and narrow gauges. It also shows in section the steel hand car wheel illustrated in the *Railroad Gazette* of March 25, 1892. This wheel is now quite generally in demand by railroad companies and is applied to hand cars, inspectors' cars, and push cars, though the common cast iron and wrought spoke wheels are supplied when wanted. This company shows hand cars, construction and push cars of various patterns and capacities and inspection cars of the ordinary types and also for steam propulsion. The application of anti-friction roller bearings to the different vehicles is shown.

**The Sheffield Velocipede Car Co.**—The exhibit of this company comprises a line of its well known velocipedes and hand cars, and gives a good idea of the different styles of inspection and push cars, logging cars, contractors' dumping cars and sugar cane cars. It also exhibits its new electric motor truck, which in the arrangement of equalizers presents some new and apparently valuable features without involving unusual complication.

**Roberts, Throp & Co.**—This firm exhibits several hand and push cars of various designs.

#### The Terminal Station at the World's Fair Grounds.

A good notion of the magnitude of the preparations for handling freight and passengers at the World's Fair may be obtained from an examination of the plan given herewith of the tracks entering the Terminal Station. These tracks show only the arrangements for trains, both passenger and freight, for the surface railroads entering the grounds. The Illinois Central, which will carry very much the greatest part of all the passengers going by the surface roads, does not enter the grounds. The terminus of the Alley Elevated Railroad on the roof of the Transportation Annex is a few yards to the north of the upper end of the passenger yard shown here. The double track of the Intramural Elevated Railroad is shown passing over the tracks of the surface railroads, just east of the trainshed.

The arrangement of tracks shown here from signal tower B to the trainshed covers a distance of about 3,300 ft. north and south. The yard proper, excluding the station tracks, has an aggregate of three and one-half miles of standing tracks, besides the running tracks and lead tracks. From this yard, tracks were led off in various directions for distributing the material to the buildings. The station tracks north of the yard were designed primarily for passenger service, but as a matter of fact they have been occupied, and still are, by freight cars. There are 35 of these tracks, ranging in

length from 830 ft. to 1,050 ft. It will be observed that they are laid out in groups of three; each track is shown on the plan by centre lines only. In the groups of three the two outer tracks are designed to receive trains, and as the trains run in the engines are to be cut off and run out around the trains through the middle track.

It will be observed that the trainshed and terminal station are of magnificent dimensions. The terminal station itself is a three story building with capacious offices, halls and waiting-rooms. It is probable that the track room provided has not been more than sufficient for the emergency of installation, but there is no doubt that it is far in excess of what will be needed for passenger service during the Fair. As a matter of fact it does not seem likely that a great many trains will be run into this station. The Chicago & Northern Pacific and the Baltimore & Ohio have arranged for a joint service of three trains each way every day; these to be increased ultimately to a train every 15 minutes if the traffic warrants it; but it is highly unlikely that the traffic will warrant it, because these trains can get little or nothing from the city proper, and can only serve, conveniently, suburban traffic to the fair grounds. The Illinois Central has declined entirely to use this terminal, but will land all its passengers outside the grounds. The Pennsylvania system and the Lake Shore have eight tracks, as will be seen, which, it goes without saying, is far more room than they will be likely to have any use for. The services mentioned above, it will be seen, will at most occupy but 11 out of the 35 tracks. What is to be done with all the rest of them is conjectural. Nevertheless the

tracks have served a valuable purpose for handling freight, as they will again next fall, when the exhibits are removed. There is no such compensating feature, however, in the terminal station itself. That colossal structure will probably be an empty and resounding shell all summer; still, this is the only considerable mistake that one can discover in the World's Fair arrangements.

It will be observed that there are two signal towers, A and B. In both of these towers the Wuerpel interlocking system is installed. Illustrations and a description of this system as used in the Union station at St. Louis may be found in the *Railroad Gazette* of Sept. 16, 1892. As installed at Chicago it has been considerably modified. Here the motive power is steam. At the tower end of each circuit for a switch is a system of three cylinders, end to end, with a continuous piston rod through all three. The steam cylinder is between two hydraulic cylinders. At the switch end are two hydraulic cylinders with a continuous piston rod; but between these, instead of the steam cylinder, is a rack and pinion movement. Steam, being admitted to the cylinders, moves the pistons in all three and displaces water in one of the attached cylinders, and the water is forced through the pipe connection to the switch cylinders moving their pistons. A return pipe is attached to the other end of the cylinders actuating the switch, by which the water displaced returns to the cylinder at the tower. It will be seen that each switch requires a steam cylinder and four hydraulic cylinders, besides a rack and pinion movement, and that it requires also two lines of pipe connection. It has been found that it takes a steam pressure of 100 lbs. per sq. in. to operate the switches; therefore this pressure must be constantly maintained in the boilers.

In tower A there are 153 working levers and seven spare levers. These levers operate 14 slip switches, 7 crossovers, 49 single switches, 10 route signals, 67 dwarf signals and many detector bars and locks. In tower B there are 54 working levers and 16 spare. These operate six slip switches, two crossovers, 20 single switches, 4 route signals and 28 dwarf signals, and

course, this is true of every point in the tread of the wheel. Sliding of one surface over the other does not occur.

The coefficient of static friction is not only greater than that of dynamic friction, but it does not decrease, if at all, as rapidly as the latter, as the speed increases. To prove this experimentally in service would require considerable apparatus and the experiments cover a wide range of conditions. From 1875 to 1881 I made many experiments upon freight trains in which the pull on the drawbar, the time and revolutions of the drivers were autographically recorded. In two special trials on

DATA FROM DIAGRAMS WITH MR. DUDLEY'S REPORT OF AIR BRAKE TESTS.

Diagram No.	Type of brake.	Number of test.	Train, uniform or mixed.	Initial speed, in miles an hour.	Stored energy in train, foot-pounds.	Distance run W. train, before stopping feet.	Do N. Y. train, feet.
40..	W.	1 & 2	"	32.0	59,085,720	373	....
				26.78	41,381,280	270	....
41..	"	1 & 3	"	34.48	68,598,814	411	....
				26.78	41,381,280	270	....
42..	N. Y.	1 & 2	"	32.0	59,085,720	450	....
				26.78	41,381,280	310	....
43..	"	1 & 3	"	34.48	68,598,814	470	....
				26.78	41,381,280	310	....

the Boston & Albany Railroad, the freight locomotives being purposely loaded to test the slipping of drivers, and with an adhesion of .30 to .33 on a dry rail, we did not detect any difference in the rate from 0 to 12 miles per hour. On the same road, on passenger trains, trying to make the running time when frequently checked by block signals, the locomotives working as hard as possible up to 50 miles per hour, not the slightest evidence of slipping was obtained. The recent high speeds of trains up to 80 miles per hour have not given evidence of slipping so far as I can ascertain. While these facts do not prove that no change in the rate of the coefficient of static friction occurs as the speed increases, they show that if desired a larger percentage of its value can be utilized at high speeds than is now used.

The coefficient of dynamic friction decreases rapidly as the speed increases, as will be seen from the table given, and indirectly by the coefficients of static friction obtained from the trials.

In the brake experiments I made for the Eastern Rail-

TABLE X.—COEFFICIENT OF FRICTION AS AFFECTED BY TIME.

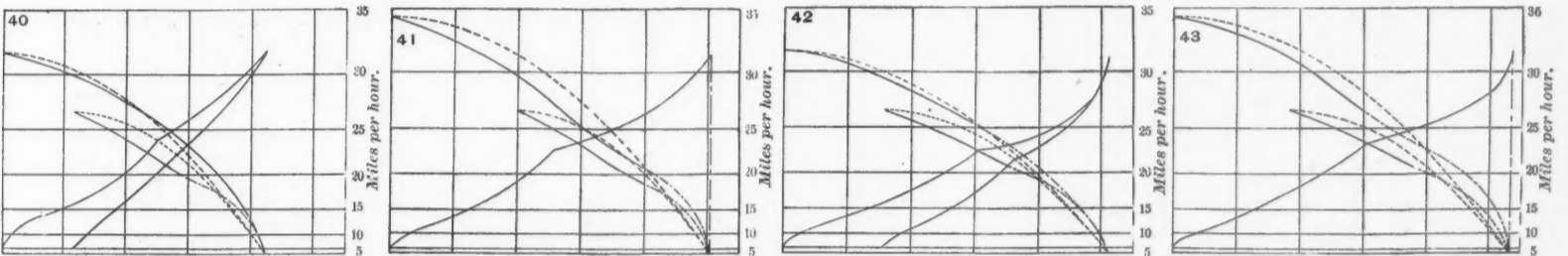
Speed. Miles per hour.	Coefficient of friction.				
	Commencement of experiment.	After 5 seconds.	After 10 seconds.	After 15 seconds.	After 20 seconds.
20	.182	.132	.133	.116	.099
27	.171	.130	.119	.081	.072
37	.152	.095	.083	....	....
47	.132	.080	.070	....	....
60	.072	.063	.058	....	....

The trials at Karner indicate that the distance run after the shoes were applied was quite as important a factor as time in reducing the coefficient of dynamic friction.

COMPARISONS OF "GALTON'S TABLE NO. X." BY THE DISTANCE RUN IN FEET AFTER FIVE SECOND INTERVALS SHOWING REDUCTIONS OF COEFFICIENT OF FRICTION.

Speed and Coefficient.	5 seconds.	10 seconds.	15 seconds.	20 seconds.
20 Miles	147 ft.	291 ft.	441 ft.	588 ft.
Reduction.	.152	.133	.118	.099
27 Miles	130 ft.	266 ft.	404 ft.	541 ft.
Reduction.	.130	.119	.081	.072
37 Miles	272 ft.	544 ft.	816 ft.	1088 ft.
Reduction.	.152	.083	.069	....
47 Miles	315 ft.	631 ft.	946 ft.	1261 ft.
Reduction.	.080	.070	.058	....
60 Miles	440 ft.	880 ft.	1320 ft.	1760 ft.
Reduction.	.063	.058	.055	....

I have added to Galton's table No. X. the number of feet of the tread of the wheel passing under the shoes, or the distance run after the brakes were applied, showing the reduction of the coefficient of friction. The figures in reference to the distance run are plotted on diagram No. 39. The reductions in the coefficients are



DIAGRAMS SHOWING THE AVERAGE FRICTION OF THE BRAKESHOES THROUGHOUT THE TRAIN.

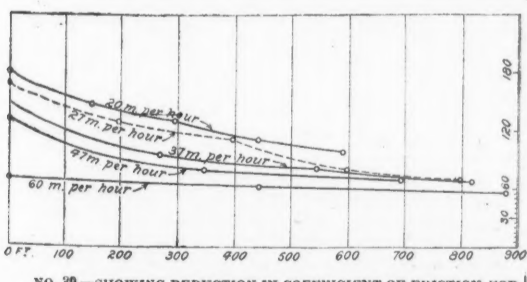
The line of 30 miles an hour corresponds to a coefficient of static friction of wheels on dry rails, which is assumed to be .290. This gives the vertical scale of the coefficient of friction for all parts of the curves of coefficient of friction.

DIAGRAMS WITH MR. DUDLEY'S REPORT ON THE WEST ALBANY BRAKE TRIALS.

detector bars and locks. Of the efficiency of the locking there is nothing to be said now, as the complete locking has not yet been put on the machines.

#### Brakeshoe Friction—Deductions from the West Albany Brake Trials.

Last week we gave important extracts from Mr. P. H. Dudley's report on brake trials made at Karner, West Albany, last September. That portion of the report which treats of the coefficient of friction we re-



NO. 39.—SHOWING REDUCTION IN COEFFICIENT OF FRICTION FOR THE DISTANCE RUN, FROM GALTON'S EXPERIMENTS.

The speeds corresponding with the curves on diagram 39 are as follows: Commencing at the bottom curve, which is for 60 miles an hour; the others are 47, 37, 27 and 20, respectively.

print now as being a valuable special monograph entirely apart from any question of the relative efficiency of the two brakes.

No matter how elaborate the brake mechanism may be to secure the best results it must be applied with reference to obtaining the highest values of the coefficient of dynamic friction, (that of the sliding surfaces between the brake shoes and wheels) without at any time exceeding the coefficient of static friction (the adhesion between the wheels and rails), the friction between surfaces not sliding, but one or both may be rolling. Although the wheels in motion roll over the rails and new surfaces are brought into contact, the circumference of each wheel laps precisely its length upon the rails, and so far as the surfaces of contact are concerned, the friction seems to be the same as though the wheels were at rest. If a particle in the tread of the wheel is considered it does come to rest upon the rail for an instant in each revolution as it changes from the downward curve of one cycloid to the upward branch of the next, and, of

road Association in 1876 and 1877, I found the coefficient of friction between the brake shoes and wheels to decrease as the speed increased. The statement was contrary to the books and was said to be impossible. The extensive experiments of Messrs. Galton and Westinghouse in 1878 with special appliances to investigate the coefficients

TABLE IX.—COEFFICIENT OF FRICTION AT VARIOUS SPEEDS, CAST IRON BRAKE BLOCKS ON STEEL TIRES.

No. of experiment from which the mean is taken.	Velocity.		Coefficient of friction.			
	Miles per hour.	Feet per seconds.	Extremes observed.			Mean.
			Maximum.	Minimum.	Mean.	
12	60	88	.123	.058	.074	
67	55	81	.136	.069	.111	
55	50	73	.153	.050	.116	
77	45	66	.179	.080	.127	
70	40	59	.194	.088	.140	
80	35	51	.197	.087	.142	
94	30	44	.198	.095	.164	
70	25	36½	.205	.108	.166	
69	20	29	.240	.133	.192	
78	15	22	.280	.131	.223	
54	10	14½	.281	.161	.242	
28	7½	11	.325	.123	.244	
20	Under 5 just moving.	Under 7 just moving.	.340	.156	.273	
Fleming Jenkin Steel on steel			.0002 to .0086	.337	.365	.351
RENNIE.						
Static friction under pressure of 180 lbs. per sq. in.						.300
Pressure, 336 lbs. per sq. in.						.347

of friction not only confirmed the general statement but they extended the observations beyond anything then or since undertaken. In most publications only the mean coefficients of their tables are quoted, and as it is often desired to know the extremes they obtained I insert the 27, table No. IX. in full, as published in the proceedings of the Institution of Mechanical Engineers, London, for April, 1879. I have also added from the same paper their table No. X. showing the influence of time as affecting the coefficient of friction.

very rapid for the slower speeds; as the distance increases falling nearly to that of the higher speed in 800 or 900 ft. The curves show how difficult it was to obtain the coefficients in table No. IX. (Galton), and the fact that there are not larger variations indicates how carefully the work was done. With the selected materials now used for brake shoes and the higher speeds of today, it is important to repeat those experiments upon the coefficients under present conditions of service. The approximate percentages of the coefficients of static friction realized at Karner in trials Nos. 1, 2 and 3 and for each train, are given below:

WESTINGHOUSE TRAIN NO. 1.			NEW YORK TRAIN NO. 1.		
26.78 miles to 25.1	.057		26.78 miles to 26.30	.049	
25.1 " 20.1	.148		26.30 " 24.40	.062	
20.1 " 5.8	.249		24.40 " 19.30	.148	
5.8 " 0.0	.322		19.30 " 7.20	.206	
			7.20 " 0.00	.313	
WESTINGHOUSE TRAIN NO. 2.			NEW YORK TRAIN NO. 2.		
32.00 miles to 30.6	.037		32.00 miles to 31.00	.039	
30.6 " 27.8	.107		31.00 " 29.00	.080	
27.8 " 22.5	.186		29.00 " 25.50	.124	
22.5 " 10.8	.255		25.50 " 19.60	.175	
10.8 " 0.0	.321		19.60 " 7.50	.215	
			7.50 " 0.0	.324	
WESTINGHOUSE TRAIN NO. 3.			NEW YORK TRAIN NO. 3.		
34.48 miles to 33.6	.039		34.48 miles to 33.60	.039	
33.6 " 31.6	.084		33.60 " 31.70	.081	
31.6 " 27.4	.161		31.70 " 28.30	.134	
27.4 " 20.8	.201		28.30 " 22.40	.192	
20.8 " 5.0	.267		22.40 " 12.20	.230	
5.0 " 0.0	.320		12.20 " 5.00	.276	
			5.00 " 0.00	.320	

The approximate curves from the figures are plotted upon the diagrams Nos. 40 to 43 inclusive, and are only presented as approximations to indicate some of the many complicated phases of the brake problem irrespective of any kind of brake. To obtain these figures we are obliged to deal with the average of the trains as a whole, and from the speed of the locomotive only. Of course all minor irregularities cannot be assigned their proper values or positions in the curves.

The area of the approximate percentages of the coefficient of static friction in No. 1 Westinghouse train is above the mean, while the New York train is below. In trial No. 2 the New York train has the greater area, while the total area for the three trials for each train is as follows:

Westinghouse.....	54.90 sq. in.
New York.....	55.05 "

These are closer comparisons than I expected to obtain from the meagre data.

The coefficients of dynamic and static friction being so widely apart at high speeds, but almost the same at low speeds, at once limits the constant brake shoe pressure to that which will not skid the wheels at or near the stop. With the M. C. E. standard of 70 per cent. of the weight of the empty freight cars as pressure on the brakeshoes, even after the air was fully applied, no-

where near the full value of the coefficient of static friction was or could be realized until near the stop. For full loaded cars it would be still less, the distance required to stop the train being nearly trebled. For empty freight cars, emergency stops, the 70 per cent. standard is near the limit for a dry rail and equalized brakeshoe pressure, for when the brakes are applied the transfer of weight from the rear wheels to the front wheels of the trucks often lessens the adhesion of the former sufficiently to skid them. This was reported as occurring for a few feet on the rear cars of both trains in the early trials at Karner, and confirmed as being possible by further trials at your Sixty-fifth street yard.

The coefficient of static friction, for all we know to the contrary, remains constant for all the speeds of present practice, and on a dry rail has a safe working value of .200 for the weight of the empty cars used in the trials, and on the energy diagrams is approximately represented by the line marked 30 M. per hour. The space below that line to the curve obtained shows the possibilities of practice, the length of stop being correspondingly reduced. For a "moist, slimy" rail the coefficient reduces to about .200; the line marked 25 M. per hour approximately represents the working limit of static friction, but this can be so readily controlled when required that it need not be taken as the limit for general practice. It is also to be noted that when the coefficient of static friction is reduced by a slimy rail, the dynamic friction between the wheel and shoe is also likely to be reduced from slime on the tread of the wheel.

Referring to table No. IX. (Galton), giving the approximate coefficients of dynamic friction at different speeds, it will be readily seen that, if you wish to utilize more nearly the full value of the coefficient of static friction for your fastest passenger trains and loaded freight trains, you can largely increase your brake shoe pressure at high speeds, reducing as the speed decreases.

The curves seem to indicate that at 60 miles you could more than double your present brakeshoe pressure, reducing to about one and one-half times at 40 miles and then reducing to the present for the stop. Practice must determine, however, the pressures which can be used. For the loaded freight trains, the auxiliary pressure would depend upon the increased load per wheel, as well as the speed. This practical fact was pointed out in the Galton-Westinghouse experiments in

factors in the breaking apart of the trains, as well as brake shoes.

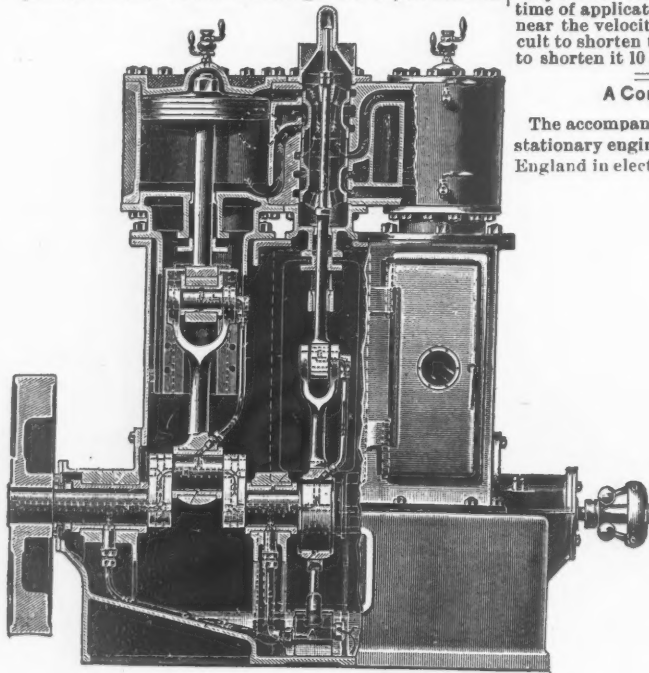
While it seems probable that brakeshoes can be made which will hold their coefficient of friction more nearly constant longer than usual, the fact can only be determined by practice. Examinations under the microscope of the surface of a few of your worn cast iron shoes show in general abrasion at all speeds, but they indicate at high speeds a wearing away of the metal by flowing off and reducing to thin flakes, some portions attaching and filling interstices made in preceding stops, others detaching in small particles; while at slow speeds, especially near the stop, the metal seems to be torn out in larger particles, scoring deeper and producing an effect similar to that of sanding the shoe, though in less degree. To secure effective braking, there are many things to consider, independent of the system of brakes.

The M. C. B. Association recommendations of tests for standard air brakes do not state whether the time interval from the first to the fiftieth car of 3½ seconds and 55 lbs. pressure in the latter shall be measured on a 50-car train, either standing, running or on a track. The time received of rack tests, 6 in. piston travel, indicates .3 of a second less than I obtained in the standing tests. It should be shorter, for the air only has to do the work of pushing out the piston 6 in. and compressing the release spring, permitting a more rapid piston travel and reduction of the train-pipe pressure than is possible when the brakes are applied on the cars. In the running tests the time will likely be nearly .1 of a second shorter than in the standing tests of the same cars. Whether or not these allowances for such comparisons are the proper ones, subsequent tests must determine. The time interval and maximum pressure recommended by the M. C. B. Association show the importance they attach to the principle of applying the air as quickly as possible to the entire train. In the time of applying the air to the entire train, the tests at Karner indicate the great advance made in braking over the experiments at Burlington in 1886 and 1887.

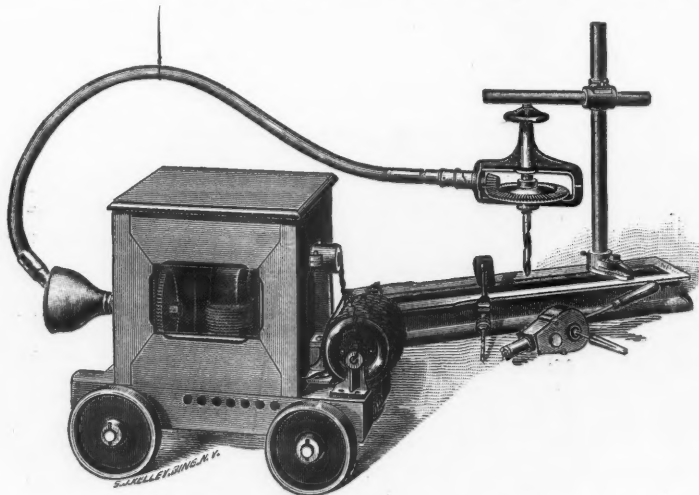
In 1886, on a 50 car train, 13 seconds is the time reported for the air to apply on only the twenty-fifth car, and with improved valves 4½ seconds, in 1887. At Karner, Nos. 1 and 2 trials, the air was applied and the train stopped in 11 and 12 seconds respectively, the air being fully on one train in less than 4 seconds. The present time of application from the first to the fiftieth car is so near the velocity of sound waves that it is more difficult to shorten the time .1 of a second now than it was to shorten it 10 seconds in 1886 or 2 in 1887.

#### A Compound High Speed Engine.

The accompanying cut shows a compound high speed stationary engine used quite extensively at present in England in electric light stations and similar plants.



Belliss & Co.'s Compound High-Speed Engine.



The Stow Flexible Shaft and Electric Motor.

England, but, the conditions of service not requiring this increased brake power, the necessary experiments to reduce this feature of the brake problem to practice have only recently been undertaken.

The table giving the "velocity heads" for different speeds shows that, for the heavy or high speed trains the energy to be destroyed is so great the brake mechanism must not only be efficient, but ample to bring the train under control from the distant to the home signal in emergencies.

Diagram No. 39, showing the reduction of the coefficient of dynamic friction after the brakes were applied, refers, of course, more to a constant speed than the decreasing speed of a stop. There is little question, however, that with our ordinary brakeshoes, every stop, unless exceedingly short, is so affected except for the last few feet—particularly of emergency stops.

The trials at Karner also show the decrease after application—at least to some part of the train. This feature, and the rear unbraked cars running up against the front braked ones, seem to have modified the mean curves of realized static friction, so the curves are not continuous, but have two branches, the least modification from a continuous curve being in the shortest stops. This will be noticed in all the friction diagrams, Nos. 40 to 43 inclusive.

The curves of the locomotives have very decided branches, and the curves of the front cars are not only longer than the rear cars, but decidedly flatter. For example, the Westinghouse train in trial No. 2 stopped in 11 seconds.

The locomotive had the air applied the full time, the next car a fraction of a second shorter, and so on for each car, the time reducing to about 8.5 seconds on the fiftieth car. The curve of friction for the front and rear cars of each train would be quite similar to those shown on diagrams Nos. 40 and 42, the curve for the front cars corresponding to the curve for No. 2 trial, and for the rear cars to the curve of No. 1, the quickness and intensity of action increasing from the front to the rear of the train. The strains thus induced or grouped had to be equalized by the draft rigging, which broke in each train for all emergency stops after the seconds trials. The capacity of the draft spring, strength and soundness of the steel castings of the drawbars and knuckles, are also

The engine is of the ordinary double acting type with a casing surrounding the working parts to prevent dirt getting at them and to permit of a liberal lubrication without waste of oil. Lubrication is accomplished through a small pump working from the main eccentric and supplying oil to the bearings through a system of channels at a pressure of about 10 lbs., thus insuring a perfect supply of oil to the parts subjected to the heaviest pressures and most liable to run dry. The cranks are set directly opposite one another, at an angle of 180 deg., and the steam distribution is effected through a single piston valve, the exhaust steam from the high pressure cylinder passing through the valve directly to the same end of the low pressure cylinder. The speed of the engine is regulated by a crank shaft governor. The builders of this engine are G. E. Belliss & Co., of Birmingham, England.

#### The Stow Flexible Shaft Electrically Driven.

The Stow flexible shaft has been in use nearly 20 years and is too well known to need description. There has been a growing tendency to increase the range of this tool beyond that for which it was originally designed. This demand has been met, from time to time, by increasing the length of the driving rope and adding extra idlers, but the objection has been urged that when traveling cranes or other overhead machinery were used the driving rope is in the way. The Stow Manufacturing Co. says that these objections are overcome by the use of the shaft in connection with a specially designed low-speed electric motor. The company has had this combination under consideration for two years and now offers an electric portable drilling, tapping and reaming plant that can be carried to any distance from the

source of power. This motor has a normal speed of about 600 revolutions, which can be increased by a rheostat to 1,000 and 1,200 and reduced by gears to 275 without loss of power. These motors are for a voltage of either 110, 220 or 500.

#### Engineers at the World's Fair.

There are several quite distinct organizations at Chicago the purpose of which is to provide for the engineers' share in the World's Fair and for the interest and comfort of engineers visiting the Fair. The first of these is the General Committee of the World's Congress Auxiliary on the International Engineering Congress. This congress is to be held at the Permanent Memorial Art Palace, Lake Front Park, Michigan avenue, at the foot of Adams street, beginning July 31 and ending Aug. 5. It is the purpose to have a general session, opening the congress at 10 o'clock Monday, July 31, and after that to divide the congress into seven divisions, namely: civil engineering, mechanical engineering, mining engineering, metallurgical engineering, engineering education, military engineering and marine and naval engineering. The affairs of the first three divisions are under the direct charge of the secretaries of the three great societies. The metallurgical engineering division is also in charge of Dr. R. W. Raymond. The division of engineering education is in charge of Prof. I. O. Baker, of the University of Illinois; military engineering in charge of Major Clifton Comly, U. S. A.; and marine and naval engineering in charge of Commodore George W. Melville, U. S. N. Mr. E. L. Corthell is Chairman of the General Committee of the Engineering Congress Auxiliary; Mr. D. J. Whittemore, Vice-Chairman; and Mr. Max E. Schmidt is the Secretary of the committee, and offices have been established at 10 Van Buren street.

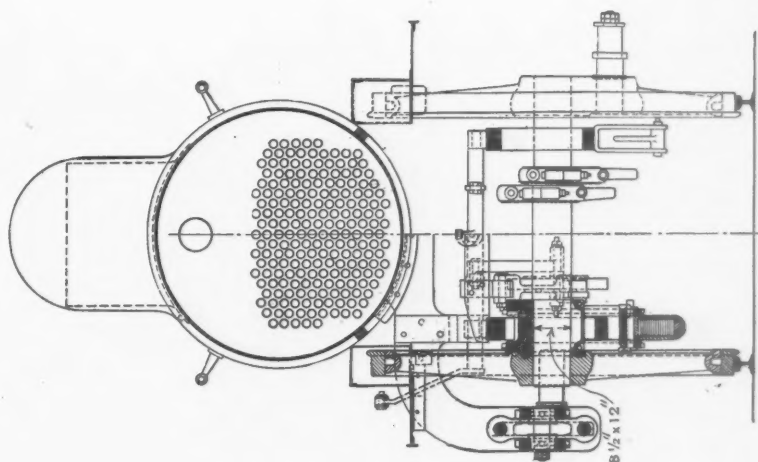
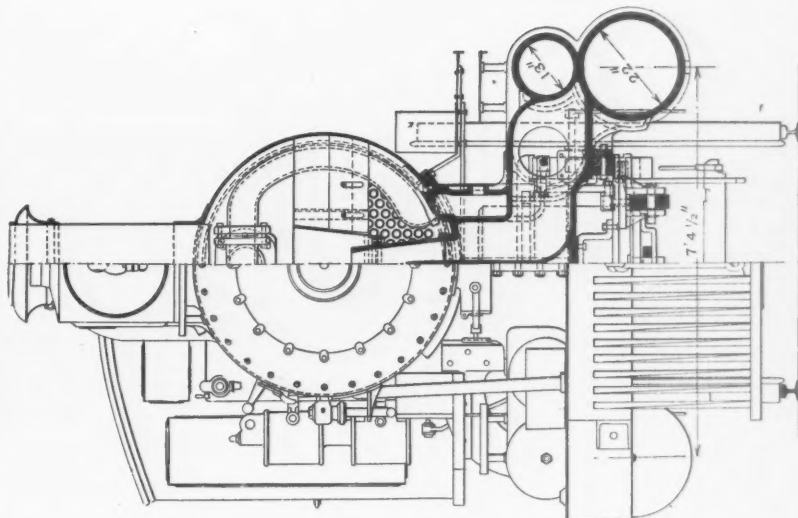
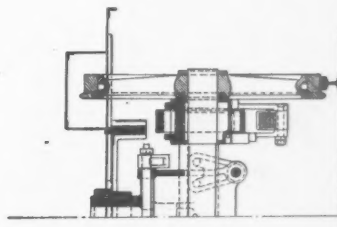
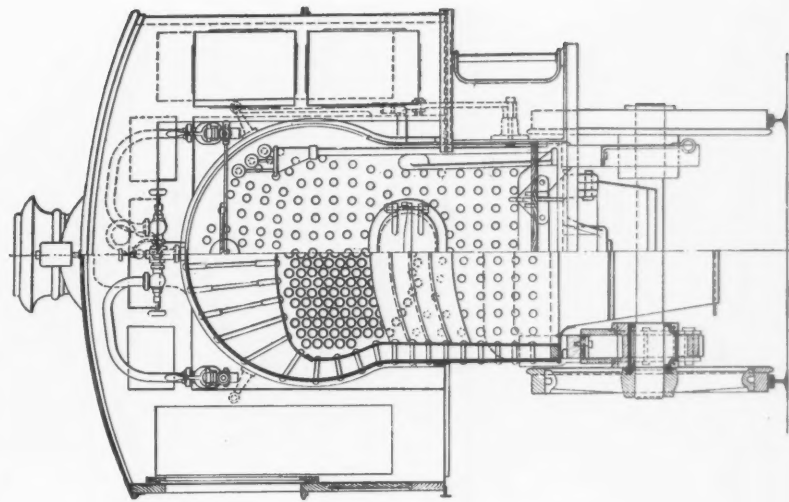
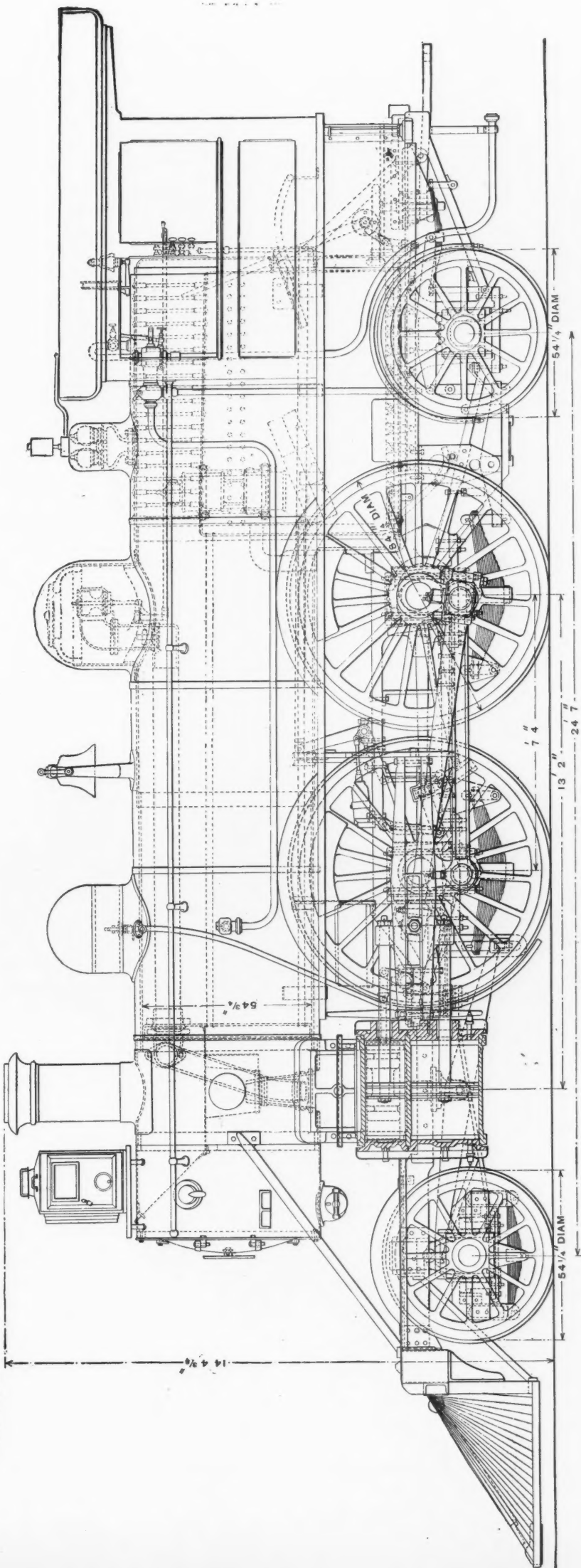
The executive business of the congress and preparations for the comfort of engineers have been organized under the General and Executive Committee of the Associated Engineering Societies of the United States and Canada. Mr. O. Chanute is President of the General Committee, and Mr. E. L. Corthell Chairman of the Executive Committee. Mr. Max E. Schmidt is Secretary and the offices are at the same place as those of the World's Congress Auxiliary, namely, 10 Van Buren

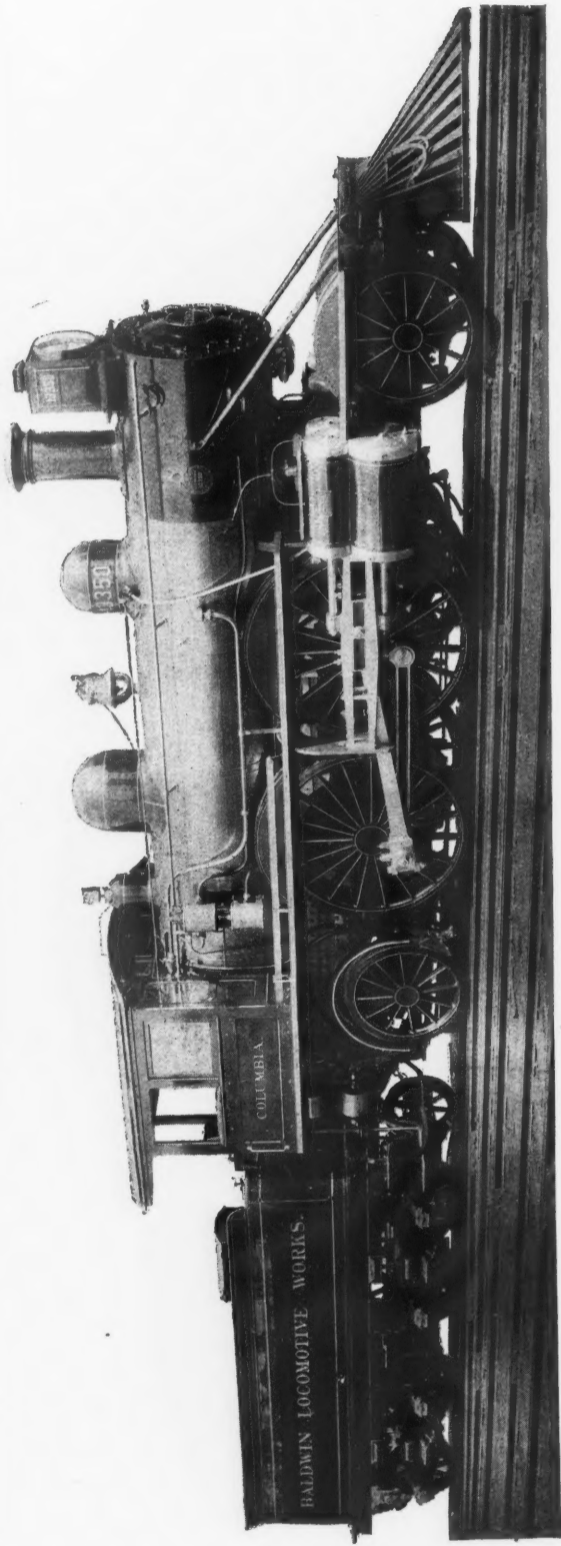
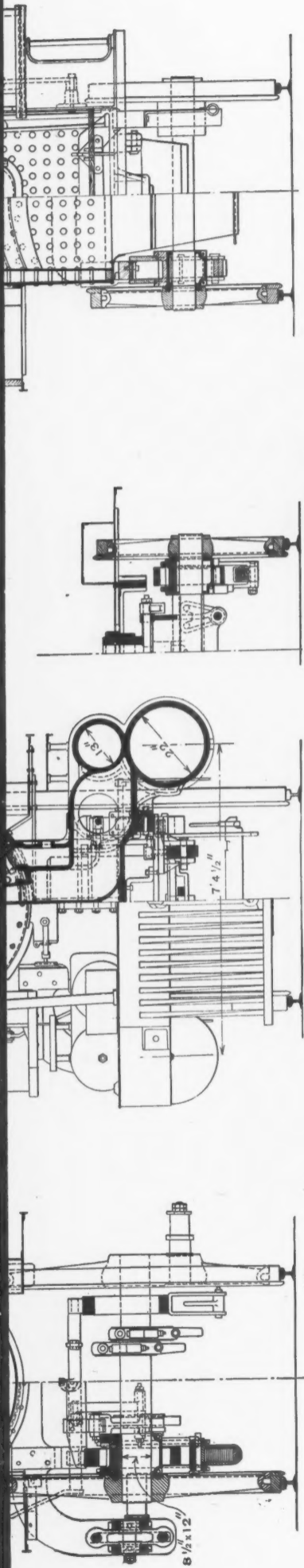
street. Here reception-rooms will be maintained throughout the continuance of the Fair, and arrangements will be made for the convenience and comfort of engineers visiting the city. It is proposed to have in attendance at the rooms several assistants who can speak the principal European languages, and it is expected that engineers visiting the city will, if they choose, have their mail sent to these rooms. Besides this, the Associated Societies will have committee-rooms in the Mines and Mining Building, where the Secretary or some of the staff will be present during the Exposition. It well known to most of our readers, doubtless, that a considerable fund has been raised by the Associated Societies for the purposes of the General Committee. At least 16 societies are included in the arrangement.

The Committee has taken steps to make it practicable and convenient for engineers from abroad to arrange for visits to points all over the country where they will find works of special interest to them. It has not been attempted to secure transportation, but to get together information that will be useful to visiting engineers. To that end the Committee has asked the City Engineers of all the cities in the United States of over 15,000 inhabitants to send in classified lists of works and industries of note in their vicinity, with the names and addresses of the managers or engineers in charge, and has asked from such managers and engineers permission to refer visitors to them.

The Western Society of Engineers of which Mr. R. W. Hunt is President, and Mr. John W. Weston, Secretary, has made arrangements for the social enjoyment of visiting engineers. It is the purpose now to have through the summer a series of dinners at frequent intervals, and it is intended that these dinners shall not

ACCOMPANYING THE RAILROADGAZETTE, MAY 25, 1893.





COMPOUND EXPRESS PASSENGER LOCOMOTIVE, "COLUMBIA"—SPECIAL HIGH SPEED TYPE.

*Built by the BALDWIN LOCOMOTIVE WORKS.*

*Exhibited at the WORLD'S FAIR.*





be burdensome in cost, but rather that the effort shall be to make them popular and get out a large attendance. The first of these was the dinner to Mr. James Dredge, which was held in the latter part of April and was very successful in numbers attending and in the spirit that prevailed.

Beyond all this there has been organized a temporary Club of 50 engineers resident in or near Chicago, the purpose of which is to give two dinners a month to distinguished gentlemen who may visit Chicago. This club has been organized by the election of Mr. C. L. Strobel, President; Prof. H. B. Herr, Vice President; Mr. John W. Cloud, Secretary, and Mr. Emil Gerber, Treasurer.

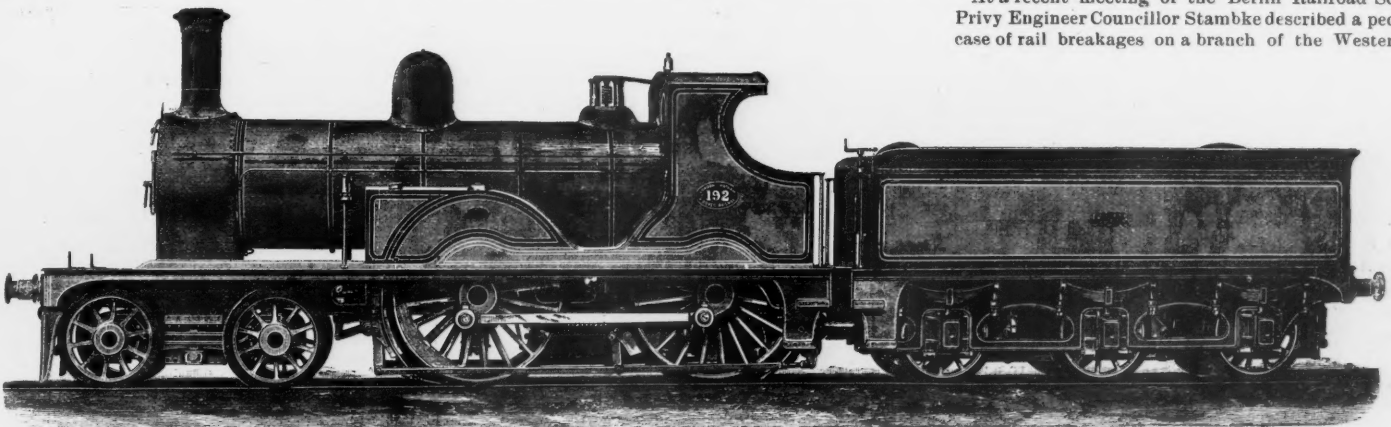
#### Express Passenger Engine—London, Chatham & Dover Railway.

We illustrate one of the new four coupled bogie express engines which the Vulcan Foundry Company has lately built for the London, Chatham & Dover, the designs of Mr. William Kirtley, M. Inst. C. E., Locomotive Engineer. We reproduce the engraving and description from the *Railway Engineer*.

These engines work the fast expresses which run in connection with the continental steamers, and some part of the line is very heavy, but the ruling gradient is 1 in 100. The weight of the trains varies from 150 to 220 tons, and the time allowed for the 74 miles between Herne Hill and Dover Pier is 96 minutes, so that the average speed is 46.2 miles per hour. The engines have worked very satisfactorily, and consume only 32 lbs. of coal per mile.

The following are the principal dimensions and particulars:

	Ft.	In.
Cylinders, diameter.....	1	6
stroke.....	2	2
Steam ports.....	1½	1
Exhaust.....	3½	1
Lap of Valves.....	1	1
Max. travel of valves.....	3½	1
Lead full gear.....	3	1
Length of connecting rod cre. to cre.....	6	4
Crank pins.....	7¼	in. diam. ×
Piston rod diam.....	3	1
<b>Frame (steel):</b>		
Thickness.....	1½	in.
Distance between.....	4	0
Length of frames.....	27	4
Width over footplates.....	7	10
<b>Wheels (cast steel):</b>		
Diam. of driving and trailing wheels.....	6	6
" bogie wheels.....	3	6
Tires, thickness.....	3	3
Driving wheel base.....	6	6
Total wheel base.....	21	4½
Coupling rod crank pins.....	4	in. diam. ×
Throw of coupling rod cranks.....	11	1
Section of coupling rod ends.....	1½	in. × 4 in.; middle, 1½ in. × 4¾ in.



EXPRESS PASSENGER LOCOMOTIVE—LONDON, CHATHAM & DOVER RAILWAY.

<b>Axles (steel):</b>			
	Bogie.	Driving.	Trailing.
	In.	In.	In.
Diam. of centre.....	5¾	7½	7½
Bearings, diam.....	6	7½	7½
length.....	9	7½	7½
Wheel seats, diam.....	7½	9	9
length.....	6½	7	7
Between cre. of bearings.....	3 ft. 7	4 ft. 0	4 ft. 0
Crank axle webs, inside, 12 in. × 4½ in. Outside, 12 in. × 4½ in.			
<b>Boiler (steel):</b>			
Working pressure 150 lbs.			
Length of barrel, telescopic two plates.....	10	5	
fire box casing.....	5	11	
Width.....	3	11	
Diameter of barrel, largest.....	4	3	
Depth of firebox casing below cre. line.....	5	2	
Thickness of plates in barrel.....			
" front and back casing.....	7	2½	
" covering.....	7	2½	
front tube plate.....	7	2½	
Height of centre above rail.....	7	2½	
<b>Firebox (copper):</b>			
Length inside bottom.....	5	3	
Width.....	3	3	
Depth.....	6	0	
Top of box to inside of shell.....	1	3	
Thickness of tube plate 1½ in. and ¾ in. covering and back plates ½ in.			
<b>Tubes (copper):</b>			
205 1¾ in. diam. outside.			
Length between tube plates.....	10	9½	
Diameter of blast nozzle.....	13	4½	
Height of chimney from rail.....	13	3½	
<b>Heating surface:</b>			
Tubes.....	1,010 sq. ft.		
Firebox.....	110		
Grate area.....	1,120		
Tender:			
Wheel base.....	12	0	
Diam. of wheels.....	3	9	
Capacity of coal bunker 4½ tons.			
water tank 2,600 gallons.			

#### Weight of engine:

	Working order.	Light.
Tons cwt. qrs.	Tons cwt. qrs.	Tons cwt. qrs.
Bogie wheels.....	13 11 0	12 0 0
Driving wheels.....	15 13 3	15 11 0
Trailing wheels.....	13 4 1	11 7 0
Total.....	42 9 0	38 18 0

#### Weight of tender:

	Working order.	Light.
Tons cwt. qrs.	Tons cwt. qrs.	Tons cwt. qrs.
Front.....	11 8 2	11 8 2
Middle.....	11 10 1	11 10 1
Hind.....	11 4 2	11 4 2
Total.....	34 3 1	34 3 1

Maximum weight of engine and tender in working order..... 76 12 1

#### Rogers Locomotives for Chili.

We stated recently that the Rogers Locomotive & Machine Works, of Paterson, N. J., were filling an order for eight six-wheel switching engines for the Chilean Government Railroads. An engine of this class was built at the Rogers works, for Chili, about eight years ago, and has been in constant service there ever since. The present order for eight engines was received from the Director-General of Government Railroads, by cable, these engines to be duplicates of the original one. They have six drivers coupled and no truck, and have saddle tanks on the top of the boilers and a fuel-box for coal on the extension of the frame, back of the boiler head. Their dimensions are as follows:

Gauge.....	5 ft. 6 in.
Cylinders.....	13 in. × 22 in.
Diameter of driving wheels.....	50 in.
Boiler, straight top, diameter at smokebox.....	44 in.
Thickness of steel plates in boiler shell.....	¾ in. and ¾ in.
Tube sheets.....	¾ in. and ¾ in.
Water spaces.....	¾ in.
Tubes, iron, 2 in. diameter, No. 11 W. G.....	13 ft. 4 in. long.
Grate area.....	10.5 sq. ft.
Grate bars, stationary—air spaces.....	¾ in.
Heating surface, firebox.....	59 sq. ft.
tubes.....	755 sq. ft.
Capacity of saddle tank.....	650 gallons.

The fire doors are double, sliding on rollers operated by a lever. There is a brick arch in the firebox, supported on studs in the side sheets, and there is a deflecting plate of sheet steel extending from the upper side of the fire-door hole to within about 12 in. of the brick arch. Each engine has two No. 6 Seller's injectors, and has double exhaust nozzles 2¾ in. diameter. All of the injector pipes are of copper. The dome casing and steam chest body casing are of brass. The valves are the ordinary D valve, not balanced, operated by link

with 11,000 lbs. weight per driving wheel; one six-wheeled passenger car for first and second class passengers, with swiveling axles; one four-wheeled first-class passenger car belonging to the little branch line between the watering places Wiesbaden and Langenschwalbach; one four-wheeled flat car, with swiveling axles and capacity of 33,000 lbs.; one four-wheeled coal car, 33,000 lbs. capacity, with iron hoppers; one complete truck of an eight-wheeled passenger car and parts of another truck; a plan of Berlin on a large scale showing its transportation lines; a large model of the station at Halle, with explanatory drawings; a collection of plans and traffic tables of the great collecting and switching stations of the Rhenish Westphalian coal districts; drawings of the recently built great passenger stations at Cologne, Frankfurt-on-Maine, Hanover, Bremen and Münster (including some of the largest and finest in the world together with drawings of bridges and a great number of models, colored drawings and photographs. This is a very creditable exhibit, the transportation of which alone is a considerable expense, and the only motive for which is a desire to contribute knowledge of the art of transportation, of which art the Prussian state railroad employes are perhaps the most diligent and catholic students in the world, examining the practices of all countries, and not hesitating to recommend what seems to them available in their country, wherever they may find it.

Another remarkable exhibit from Germany is the "Track Museum" of the Osnabrück Iron & Steel Works. This museum has been gathered under the care of Mr. A. Haarmann, General Superintendent of the works, in the course of preparation of his magnificent book on "Rail-road Track," which was reviewed in the *Railroad Gazette*, Aug. 19, 1892.

#### Foreign Railroad Notes.

Of the main tracks of the through Swiss lines in 1892, 37.8 per cent. rested on iron sleepers, 32.7 per cent. on oak ties, and 49.5 on soft-wood ties. It seems astonishing here that 28.3 per cent. of the rails are still iron—possibly because the light traffic has not yet worn out the iron laid before the days of steel. The heaviest rails, 88 to 96 lbs. per yard, are used on the Gothard Railroad, but the Jura-Simplon line has 84-lb. rails.

At a recent meeting of the Berlin Railroad Society Privy Engineer Councillor Stambke described a peculiar case of rail breakages on a branch of the Westerwald

motion. The piston rod and valve stem packing is the United States, and the piston packing is of the cast-iron, spring ring pattern. The drawhead at the rear is cast steel attached to a wrought iron radial bar with 6 in. lateral play; the bumper drawhead is also cast steel. The driver brake is Westinghouse straight air, applied to two pairs of wheels. There is besides a handbrake of the screw pattern, attached to the heads and shoes of the air brake, operating through a shaft with a crank on each end.

The cabs are of walnut varnished and have wooden window sashes sliding down to open, and wooden flexible blinds inside the windows which slide up under the roof in curved grooves in the sides of the window posts and roof carlins. The blinds are light colored wood varnished, and the other parts of the engine, such as drivers, tank, fuel box, etc., are painted black and striped in gold. The connecting and parallel rods, cross heads, guides, rock-shafts, etc., are polished.

The engines weigh in working order about 75,000 lbs. They are now finished and being boxed for shipment by steamer around the Horn to Valparaiso.

#### The World's Fair Exhibit of the Prussian State Railroads.

Perhaps the easiest way to give a list of the objects exhibited at Chicago by the Prussian state railroads is to summarize the account of it given by Engineer Councillor Koch at the Berlin Railroad Society. Eight directorates of the administration have contributed toward the display, in which are one six-coupled compound freight locomotive with tender; one six coupled tank locomotive

Railroad. On a single day not long ago 81 broken rails were reported. The line is laid with longitudinal iron sleepers of what is known as the Rhenish pattern. It has grades of 88 ft. per mile, and on a very cold day a brakeman put on the brakes on a 15-ton car so tight that the wheels could not turn. On the wheels thus dragged over the rails a groove was worn a finger deep. The brakeman then broke and the wheels revolved again, striking a blow like a hammer at every revolution, causing fractures in both lines of rails opposite each other. The rails were of steel, 5.2 in. high.

The Prussian State Railroad administration has had constructed no less than 24 new fast trains of the "American system," on the general model of those put on between Berlin and Frankfurt and Berlin and Cologne last year. Most of them began running May 1. Each train has five cars, 52 ft. 6 in. long, resting on two four-wheeled trucks, with what we call "vestibule" connections between the cars, entrances at the ends and a side passage, instead of our central passage, with first and second class compartments. In each train are 126 numbered seats, 24 to 30 of which are in first-class compartments. The side passage will be run on the south side of the train in summer and on the north side in winter. Each car has two lavatories, is lighted with compressed gas and heated by steam. In the back end of the next to the last car is a kitchen (the cooking done by gas) and buffet. These buffets are rented to restaurant keepers. Seats in these trains may be engaged for half an hour before the train starts on payment of one mark (24 cents). On some of the longest routes, with about 10 hours' run, two marks are charged for a seat.



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#### EDITORIAL ANNOUNCEMENTS

**Contributions.**—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

**Advertisements.**—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

Probably foreign visitors will find the engine "Columbia," built by the Baldwin Locomotive Works, and published in this issue, one of the most attractive of the high speed passenger engines at the World's Fair, as it has some special features and is quite a new design. Some engines of this class are now running on the Reading Railroad, but we have not received details respecting their operation and economy. It is understood that they are very satisfactory. Of quite as great interest to foreigners will be the engine No. 999 of the New York Central & Hudson River, shown in our issues of April 28 and May 19, which has made the phenomenal speed of 102.08 miles an hour, or, perhaps, even 112 miles. This engine is of the type that hauls the Empire State express, and was built by the Schenectady Locomotive Works, after the designs of Mr. William Buchanan, Superintendent of Motive Power, who is certainly a leader in this country in the development of high speed locomotives. Taken altogether, these two engines are distinctly American, and it is to be hoped that those who are now endeavoring to get a competitive trial between the foreign and American engines will succeed and will be able to get these engines into the trial. It is understood that the Baldwin Locomotive Works and the New York Central Railroad, and two of the foreign exhibitors, are ready for a careful and extensive set of tests under the auspices of a representative body of engineers.

Disappointment has been expressed by some railroad officers that the World's Fair has had so little effect yet on passenger movement. The article which appears on this page, analyzing the traffic of 1876, indicates what it is reasonable to expect and supports the judgment of some of the more careful general passenger agents that the World's Fair business will be done in 120 days and the really heavy business in 90 days. Meanwhile the increased movement is beginning to be important. All of the New York lines show a gain for the first two weeks of May of about 33 per cent. over the April business in one-way tickets, and including a considerable sale of excursion tickets the gain is estimated at practically 75 per cent. over the April business; but April showed an increase of from 25 to 30 per cent. over April of last year. The story is that one of the New York roads shows a gain of 64 per cent. over the first two weeks of April, exclusive of excursion tickets; however this may be, it is evident that the increased movement is enough to justify the railroads in no further reduction of rates. The news from Chicago carries about the same lesson. It is reported that trains there are running very full, but we have no estimate of the percentage of increase. Probably no further moderate reduction of rates would do much to increase movement now. Most folks will go to the Fair when they can get away, the farmers after harvest and the city folks when the time comes to take the summer vacation and when the children are out of school. Meantime, the stories that have gone abroad all over the civilized world of the rapacity of Chicago hotel

and lodging-house keepers, merchants, shop-keepers and everybody else probably do more harm than any possible reduction in railroad fares can do good. The opinion in Europe is that only millionaires and people who have something to sell can possibly afford to go to Chicago now.

#### World's Fair Travel.

There has been much speculation over the increase of travel that may be caused by the Chicago World's Fair, and the additional profits which the railroads will reap from it; but so far as we have seen, all the arguments have been *a priori*, and one might suppose from them that we never have had any experience with World's Fair travel. It is a fact, however, of which there are still living witnesses and printed records, that there was a World's Fair in Philadelphia in 1876; that great preparations were made by some of the railroads for carrying passengers to and from it, and that the effect on railroad earnings was observable in a general way on many railroads and in a marked and special way on some.

The year 1876 fell within the prolonged period of business depression which followed the panic of 1873, was at its worst in 1877, and from which there was no decided recovery until 1879. Doubtless these are better times, and fewer people will be kept from Chicago in 1893 by sheer poverty than were kept from Philadelphia in 1876. Nevertheless the Philadelphia fair was a marked success, with a very large attendance—larger, we believe, than at any previous world's fair.

The extraordinary stagnation that prevailed after 1873 is illustrated by the course of railroad earnings. For years they grew smaller instead of greater, in spite of a not inconsiderable increase in mileage. The number of miles worked and gross earnings in millions of dollars, as reported by Poor's Manual, were:

	1873.	1874.	1875.	1876.	1877.
Miles.....	66,237	69,273	71,759	73,508	74,112
Millions of gross earnings...	\$26.4	\$30.5	\$35.1	\$47.3	\$47.9

Thus, in 1877, with nearly 12 per cent. more railroad than in 1873, earnings were 10 per cent. less, earnings per mile having fallen from \$7.947 to \$6.380 (19.7 per cent.), though the proportion of new railroad was very much greater in the earlier than in the later year. We call attention to this because otherwise it would be difficult to find any encouragement from the world's fair traffic of this year, for the railroads as a whole.

If now we turn to the passenger earnings, we shall find a similar course. The "year" of Poor's Manual ended with September for many of the most important railroads, which leaves out one of the very best months of Centennial travel, but it includes the whole calendar year for the chief beneficiary from that travel, and doubtless by far the larger part of that travel was in the year reported as 1876. Now, the total passenger earnings of the railroads of the country were, in millions of dollars:

	1872.	1873.	1874.	1875.	1876.	1877.
	132.3	137.4	141	139.1	136.1	130.1

Thus the passenger earnings were less in the Centennial year than in any of the three previous years. This does not prove that travel was not increased by the world's fair; it was, largely. But the general tendency was downward; and Centennial travel was, after all, but a small portion of the total travel. Probably but for the fair the very low figures of 1877 would have been reached in 1876. In 1877 the passenger earnings of 74,112 miles of railroad were less than in 1872 on 57,323 miles, the country meanwhile having made an important gain in population.

Centennial fares in 1876 were 25 per cent. less than the regular fares, and passengers were ticketed not only to Philadelphia, but to New York, on these tickets. This, however, was simply a measure of protection for the New York railroads. At that time it was difficult to get to Philadelphia from any part of the West without passing over the Pennsylvania Railroad; and if the reduced fares had been made to Philadelphia only, such lines as the New York Central and the Erie and their Western connections could have secured but very little of the travel, and their ordinary through travel would have been largely diverted to the Pennsylvania.

Another fact of importance is the railroad war of that year, which for most of the time the fair was open, and for all the time it was most visited, made fares lower than the Centennial rates for Chicago and many other Western points. The Chicago-New York rate went down to \$13, the regular fare then being \$22, and the Centennial round trip rate \$33. (It will be observed that the reduction of one-fifth this year makes a round trip fare of \$32, or a dollar less than the 1876 rates.) But in calculating the effect of the 1876 war rates, we must remember that there were war rates in 1875 also, although not quite so low as those of 1876.

The population of this country is now very nearly 50

per cent. greater than in 1876. But the population within 500 miles of Chicago is not more now than the population within 500 miles of Philadelphia was in 1876; and it is doubtless the population within that distance that affords by far the larger number of visitors to any world's fair. The comparatively great distance from the East to Chicago, however, is in one sense favorable to World's Fair travel, as it is precisely in the East that we find the largest number of persons able to pay for a journey of a thousand miles or so.

Travel to the Chicago fair will be very much more distributed than that to the Philadelphia fair. By far the larger number of visitors to the latter, whether from the East or the West, passed over the Pennsylvania Railroad; most of those from the South over the Philadelphia, Wilmington & Baltimore. The Bound Brook route from New York to Philadelphia was first opened in 1876 and had a heavy travel, but nothing like the Pennsylvania's. The Philadelphia & Reading had a great addition to its local travel. That the Pennsylvania was the chief beneficiary from this travel may be seen from the fact that the passenger earnings of its Pennsylvania Railroad Division and United Railroads of New Jersey Division alone were \$4,375,000 (54 per cent.) greater in 1876 than in 1875, though, as we have seen, the aggregate passenger earnings of American railroads decreased six millions meanwhile.

Some of the gains in passenger earnings in 1876 over 1875 were:

	Amt. P. c.	Amt. P. c.
Reading.....	\$70,916 30.6	Pitts., Cin. & St. L. \$150,411 20.0
Phil., W. & Balt. 608,265 34.8		Pitts., Ft. W. & C. 190,697 9.4
Balt. & Ohio.....	155,953 10.3	

On the other hand, the New York Central had a decrease of 7 per cent. in the year to Sept. 30, 1876, and the Erie a small decrease, and so also the New York, New Haven & Hartford, in respect to which it should be said that October was perhaps the best month for Centennial travel, and that the returns on Centennial tickets swelled earnings after the Fair had closed (Nov. 10) and till the very end of the year. All this shows very clearly that it was the roads nearest and leading most directly to Philadelphia which profited most by the travel—in fact, were the only lines which gained much by it.

The Pennsylvania having had an overwhelmingly large part of the business, we will examine its course on this road more minutely. On all its lines east and west of Pittsburgh, the travel, which was 562 millions of passenger-miles in 1875, rose to 882 millions in 1876, and then fell to 543 millions in 1877. Now, of the gain of 320 millions in 1876, 128 millions was on the 963 miles of the line from Philadelphia to Pittsburgh, with its branches, and 140 millions on the 293 miles of the United Railroads of New Jersey, leaving but 52 millions for the enormously greater mileage of the other lines.

Another important fact in the history of Centennial travel is its concentration in the last third of the fair season. The fair opened May 10, and during the first four months of the year the passenger earnings of the Pennsylvania and New Jersey Divisions had been:

	1876.	1875.	Increase.	P. c.
Jan. 1 to Apr. 30....	\$2,411,582	\$2,321,022	\$90,560	4.0

That is, the change had been insignificant. After the fair was opened, there was long great disappointment as to the attendance, and the passenger earnings of these two divisions for the first four months of the fair were:

	1876.	1875.	Increase.	P. c.
May 1 to Aug. 31....	\$4,023,075	\$2,815,272	\$1,207,803	41.4

This was truly a very heavy gain for a single railroad, but as it represented perhaps seven-eighths of the gain of all the railroads of the country from Centennial traffic, it was disappointing.

But with September, visits to the fair enormously increased, and thence to its close, Nov. 10, and long afterward in fact, travel was unprecedented. The passenger earnings of the two divisions of the Pennsylvania in September and October were:

	1876.	1875.	Increase.	P. c.
Sept. 1 to Oct. 31....	\$3,587,344	\$1,572,521	\$2,014,823	128.

Thus the total passenger earnings in the last two months of the fair were nearly as great as for the first four months; and the gain in these earnings, which will best indicate the Centennial travel, was nearly twice as great in the last two months as in the first four—was at the rate of \$9,576 per day from May to August, inclusive, and \$33,038 per day in September and October.

But the Centennial travelers largely visited New York and New England, and they were returning till the end of the year, with the astonishing result that the gain in earnings in November and December (the Fair having closed Nov. 10) was very nearly as great as for the first four months of the Fair, as follows:

	1876.	1875.	Increase.	P. c.
Nov. and Dec....	\$2,366,813	\$1,273,788	\$1,093,025	85.1

We must, therefore, not conclude that the Chicago Fair will have little effect on travel after all, because it is not having much now; the railroads will be wise,

probably, if they prepare to make their greatest efforts "after harvest." In fact, the harvest and farmers' work generally is likely to have much more effect on the attendance in Chicago than it had on that at Philadelphia, because there are many more farmers near Chicago; though, doubtless, in both places and at all world's fairs, the great bulk of the attendants are town-people.

As a key to the course of Centennial travel from month to month in 1876 we give below the passenger earnings of the New Jersey and Pennsylvania Divisions of the Pennsylvania Railroad in each month of 1876 after the opening of the fair; it may be useful.

	1876.	1875.	Increase.	P. c.
May	\$805,772	\$677,710	\$128,062	18.9
June	882,804	680,543	202,260	41.4
July	1,080,010	728,527	351,483	48.2
August	1,154,190	758,492	395,698	52.2
September	1,813,064	808,899	1,004,165	124.2
October	1,771,481	763,622	1,010,859	132.4
November	1,357,745	650,741	707,004	108.6
December	1,009,068	623,017	386,051	50.7

Eight months..... \$9,977,732 \$5,696,581 \$4,281,151 75.1  
The chief significance of this is in the column of increases.

The traffic on these lines was so phenomenal that the management "pointed with pride" to it in the annual report for 1876 in the following terms:

"During the Centennial season, between the 10th of May and the 10th of November, 20,231 passenger trains, with 127,296 cars and 2,343,499 passengers, arrived at the West Philadelphia station, Thirty-second and Market streets, and during the same period 22,372 trains, with 141,284 cars and 2,612,213 passengers arrived at the Centennial station, making a total of 42,603 trains, with 268,580 cars and 4,955,712 passengers. This large movement was accomplished without the slightest injury to any passengers. During the period referred to, 90 per cent. of this whole amount of passenger traffic was hauled between the hours of 7 and 11 o'clock in the morning and 4 and 7 o'clock in the afternoon."

No one line to Chicago, however, can expect to have anything like the travel which the Pennsylvania had in 1876, however popular the Chicago Fair may become, because the travel which was concentrated on the Pennsylvania will be distributed among ten or more railroads at Chicago. The shares of the different lines are likely to vary with the population, and especially with the town population, on their lines within 500 miles of Chicago. The important travel that a great city may give is indicated by the experience of the United Railroads of New Jersey, which yielded the Pennsylvania in 1876 a gain of \$2,780,317 on 293 miles, (and by far the larger part, doubtless, on the 90 miles between New York and Philadelphia), against a gain of \$1,594,395 on the 963 miles of the Pennsylvania Railroad Division—Philadelphia to Pittsburgh, with branches. There is, however, no New York within 90 miles of Chicago on any line, Milwaukee being the only large town within 100 miles.

We should not, therefore, expect a very great increase in earnings from the Chicago Fair on any one railroad; but we may be greatly mistaken if we conclude from the reports of the first months that it is having little or no effect.

#### A Suggested Economy in Freight Car Repairs.

The cost of repairs to freight cars is very greatly increased by the damages done in the yards. What proportion of the total damages comes from the breakage of parts in yard switching we do not attempt to say. One superintendent of motive power of a great system has recently said that "most" of his freight car repairs are for damages of this character. For the present purpose it is not necessary to give accurate figures, or indeed to attempt any estimate. Every superintendent of motive power or master car builder can make his own estimate, and every president or general manager or general superintendent can get from the rolling stock department figures for his own road, and it would be a good plan for some of them to do this. Doubtless, many officers would be surprised to learn how much of their freight car repair account is due to damages done in yard work and still more surprised to know how large a proportion of these damages is entirely unnecessary and comes from careless and even reckless handling. A few hours spent in watching work in different yards will show at once that there is a great difference in the method of handling cars, and an inspection of figures for different roads showing the damages to those parts that are most liable to be injured in switching, such as couplers and drawgear, will reveal a great range between the maximum and minimum percentage of breakages of these kinds on different roads. A very superficial investigation on these lines show a great and unnecessary difference between the best and the worst practice.

Here is a field for economy, and for one of those economies that can be introduced, not by the use of better mechanical appliances or better material, or in other ways increasing first cost, but by inexpensive changes in methods of administration; and it is this

class of economies that the enlightened railroad manager is constantly seeking to introduce. It is impossible to ascertain by an examination of annual reports what percentage of operating expenses represents the cost of repairs to freight cars. Looking over half a dozen annual reports we find that this item varies from 4.2 to 14.3 per cent. of the whole operating expenses. Sometimes it is reported as repairs of freight cars and sometimes as maintenance of freight cars; and in the latter instance usually includes new cars bought to fill vacant numbers and charged to operating expenses. In the case in which the percentage was 14.3 it is specifically stated that this charge is for "repairs" of freight cars; but that is a case in which the yard switching bears a very unusual ratio to the total car mileage.

Let us assume that freight car repairs represent 10 per cent. of the total operating expenses of the railroads of the United States, and that one-half of this is due to breakages in freight yards. Five per cent. of the total operating expenses of the railroads of the United States for 1892 is a little over \$39,000,000, a very substantial part of which could be saved by reasonable care on the part of yard men. Without attempting to make any precise estimate, it is obvious that here is a great field for economy, and there are at least two ways in which this particular economy can be brought about. The amount of switching may be diminished by running trains through without breaking them up at the division yards; or the yard men may be compelled or induced to handle cars more carefully.

The first method is one in which there will be considerable development in the next few years, for it is a direction in which a great deal of saving can be made otherwise than in damages to cars. A substantial part of the cost of switching cars might be saved, as well as a substantial part of the money and time lost in delays to freight trains, if solid trains can be made up at termini and run through without breaking up and re-sorting in the division yards. Of course, we are quite aware of the difficulties that superintendents always see in such a change in practice; but we are also aware that a good many of those difficulties disappear when they are attacked energetically. But the improvement in this direction will probably be a slow development; on the other hand, the improvement in yard work might be made at once, and very simply.

We suppose that most officers under whose control or observation this work comes attempt to keep yard breakages within limits by watching reports from their yards and warning yardmasters when the reports of damage get too high. But there is a steady pressure on the men to rush their cars through; and with the introduction of automatic couplers there has been an increase in the severity with which the cars are handled; they are run together faster when there is no need for the men to go between the cars to couple. So the ever present impetus to rush the work constantly outweighs the remote and more or less uncertain pressure to handle the cars carefully, and the natural question is, if the men themselves cannot be personally interested in this economy. It has been suggested that it would be a simple and profitable thing to arrange a premium system by which the yard men should get premiums based upon the records of damages to cars in their yards. Doubtless a plan could be devised by which comparative records could be made of sufficient accuracy for a basis for a system of premiums, and the men thus be enabled to share in the economy which would come from a more rational method of handling cars. Of course the old objection will immediately arise, of the difficulty of keeping the accounts; but the probability is that the extra clerical work will be saved many times over by the decrease in the repair account, and if any railroad manager wants to try this experiment we think that we can point out to him a way in which it can be done at little first cost.

#### Some Practical Points in Steam Economy.

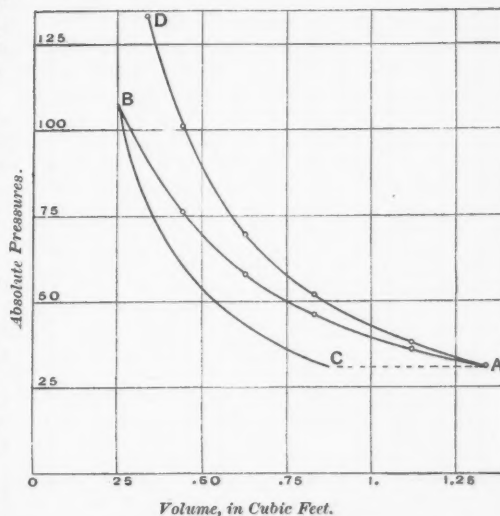
The Chapman Valve Manufacturing Company has recently issued a new edition of its catalogue which has a remarkable engineering appendix, containing articles on steam by Mr. F. W. Dean, on electrical matters by Mr. H. C. Spaulding, and on ammonia ice machines. But we did not start out to review the catalogue or its several special papers, but to speak particularly of Mr. Dean's article on the use of high pressure steam, considerable extracts from which appear on another page.

This article reviews the early history of steam engines and shows how the steam pressures have been increasing from the first. The criticism we would make of the table giving the effect of expanding steam on the economy of the engines is that it does not give practical results. This is said, however, by Mr. Dean: "The following table gives the amounts of steam per horse power per hour during different conditions, no deductions being made for the losses met with in practice." Such an analysis shows, of course, that the shorter the cut-

off the greater economy, while in point of fact this is not true except within narrow limits. From full stroke to about  $\frac{1}{4}$  stroke the table represents very nearly the saving by increasing the expansion; but from  $\frac{1}{4}$  to  $\frac{1}{10}$  of the stroke the table is much in error. This is explained in the text as follows: "Unfortunately, however, these results can never be realized in practice, as there are losses due to back pressure, clearance, friction of steam in passages and condensation."

There is an argument showing why there are losses due to back pressure, and a table showing the steam required per horse power per hour, with allowance made for losses due to back pressure when that pressure is 1 lb. per square inch. The conclusion from the table is expressed as follows: "This table shows how detrimental to economy back pressure is, and that it is not advisable to cut off earlier than  $\frac{1}{4}$  stroke in a non-condensing engine. Considering condensation, it is doubtful if a cut-off earlier than  $\frac{1}{4}$  stroke is economical in such an engine."

The explanation of the causes of loss due to clearances is very clear and easily understood. The conclusion for engines having considerable clearance is that "this shows that with compression, which is indispensable to economy, a larger steam cylinder is necessary than without compression. With the larger cylinder there is more condensing surface, however, and thus some loss of efficiency." Under this head it is also said that "in connection with this it should be pointed out that the work absorbed by compression is not lost to the efficiency



of the engine, because it is given out again by the steam when it expands the next stroke. This would be strictly true if steam were a perfect gas, and is approximately true in practice." The approximation of this statement to the truth is perhaps well illustrated by a diagram which we have made showing the actual compression line of an indicator card and the approximate expansion line that would follow if no steam was admitted to the cylinders, but instead if the steam compressed in the clearance spaces was allowed to expand. *AB* is the actual compression line, and *BC* the approximate expansion line. *AD* is the curve of equal steam weight. These curves are pretty nearly correct and represent quite accurately the loss of power by the compression in the engine we have taken, which is a locomotive having large clearance spaces. The work done on the steam by the piston in compression may be represented by 100. The comparative work done in expansion is about 50. Therefore about 50 per cent. of the work done by the steam in compression is not given out again in expansion. The per cent. of this loss for the total engine depends greatly on the point of cut-off. The longer the cut-off and the more work done, the less is the proportion of loss due to compression.

The remarks on the utilization of higher pressures are summed up in the reasons given for the greater economy of compound and triple expansion engines which necessarily must be used in order to gain any considerable advantage from higher pressures. These reasons as given are as follows:

"(a) For any given amount of expansion condensation is diminished, and; therefore (b) permits greater expansion, and thus (c) better utilizes high pressures, which, in themselves, are more economical than low. In addition if the high pressure valve leaks, the steam, instead of either being wholly lost or not working expansively in that cylinder, finds its way to the next cylinder, which may have a tight valve, and thus work to some extent expansively; and still further, steam which is initially condensed in the first cylinders and re-evaporated without working expansively in them, will work so in the later cylinders, and any water evaporated in the receivers will also work expansively in the later cylinders."

Mr. Dean has also given some useful directions about operating the steam engine indicator and some tables of results of tests of engines with and without steam jackets.

We have been unable to gather full and reliable accounts of the damage done by the floods in Ohio and Northwestern Pennsylvania, but what facts we have obtained indicate that, so far as the railroads are concerned, the dispatches in the daily papers were greatly exaggerated. The reports from Newcastle, Pa., indicat-

ed that the New York, Pennsylvania & Ohio had suffered the complete loss of a dozen miles of road and would have to spend many thousand dollars in repairing the roadbed within the limits of the city; but the officers of the road tell a different story. The principal loss was a three-span iron bridge across the Shenango River, used for carrying freight to and from an iron mill. The bridge is not a total loss. There were numerous washouts on the Franklin and Newcastle branches of this road, but the damage is not serious. There were a few slight washouts on the main line, but the worst damage was the delay to traffic occasioned by high water. The Lake Shore & Michigan Southern, which was reported as in very bad shape all the way from Buffalo to Erie, gives us a similar report. The inconvenience and loss by delay to traffic were considerable, but the washouts were all slight. Only one bridge is mentioned as damaged, and that was a small one near Harbor Creek, Pa. The abutments to this will have to be rebuilt. The Philadelphia & Erie suffered to the extent of about \$3,000 from washouts near Erie and had four girder bridges on Little French Creek carried away. These bridges were No. 8, single track, two spans, 27 ft. each; No. 13, same dimensions; No. 14, double track, two spans, 27 ft. each, and No. 15, single track, one span, 13 ft. All of these bridges were low. The abutments and piers were washed out in consequence of the bursting of a dam.

On Tuesday of this week there was a furious wind-storm at Cleveland, destroying several buildings, including one of the Cleveland Rolling Mill undergoing repairs, where three men were killed. On the same day a tornado at Louisville destroyed a number of buildings, including the round house of the Louisville & Nashville Railroad at Teuth street.

Queen & Co., of Philadelphia, who manufacture the "Thomson stick," an apparatus for testing the eyes for color blindness, have recently shown us a number of letters from railroad officers testifying to the value of examinations of this kind for trainmen and for all persons having to read color signals. These letters are from the Pennsylvania, the Baltimore & Ohio, the Northern Pacific and a number of smaller roads. It is, or should be, unnecessary to state that these letters are all alike in the opinion that examinations of this kind are an essential safeguard in railroad operation. It is safe to say that no one ever conducted examinations of this kind thoroughly and persistently who did not become convinced of their importance. Color blindness is sure to exist in about four men out of every hundred. This percentage is pretty sure to be the same among locomotive runners as among any miscellaneous lot of men if nothing has been done to weed out individuals with defective sight; for some will fail to realize its dangers while others who do realize them, more or less, will try to conceal their defect. Inability to distinguish green from red, which is a common defect, is dangerous howsoever the man may succeed in partially making up for his color-blindness by reading the indication of signals by some means other than by color. The Thomson apparatus, which was described in the *Railroad Gazette* of Sept. 9, 1887, is a frame containing colored yarns, the skeins being numbered, so that an inexperienced person, even a color-blind person, can record the selections made by an examinee, so that the expert can subsequently decide upon it without being present at the examination. Tests by yarns and other indoor apparatus are far more accurate than any experiments "with the flags and lamps actually in use," and are, therefore, entirely just to the persons examined. The foregoing elementary truths have been often published before, but we take occasion to present them again because it is evident that views contrary to them are still held with great tenacity by many railroad men who ought to know better.

The New York, Chicago & St. Louis Railroad, which was acquired by the Vanderbilt interest soon after it was opened, to prevent its spoiling the business of the Lake Shore, has developed a really large freight traffic, an overwhelmingly large part of which evidently is through business, as the average haul last year on a line 512 miles long was no less than 314 miles. But the passenger traffic remains very light, being last year at the rate of 93 persons each way daily over the whole line, against a freight movement of 2,963 tons each way daily—31½ tons for every passenger. The passenger traffic was immensely greater in 1892, however, than ever before—34 per cent. greater than in 1891 and 70 per cent. greater than in 1889. This is evidently due to the development of some through travel where formerly there was substantially none, as the average passenger journey, which was only 39 miles in 1889, and about 47 miles in each of the next two years, rose to 62½ miles last year. That the freight is chiefly through and of the lower classes is shown by the average rates, which for years have been little more than half a cent. per ton per mile, being 0.534 cent last year. The average passenger rate is one of the lowest in the country also (1.45 cents per mile last year). The freight traffic has not varied much for the last three years. With such rates, naturally, an exceptionally large proportion of the earnings is absorbed for working expenses—83 per cent. last year. The balance was enough to meet the fixed charges and leave \$150,000 for dividends on the first preferred stock, which, considering the situation of the road, is doing pretty well.

The effect of competition on the old Mexican Railway from Vera Cruz is shown very plainly in its report for the last half of 1892, and especially in its foreign freight traffic, which has usually yielded more than half its total freight earnings, and in 1890 60 per cent. of them. The amount of this traffic was about the same in 1892 as in 1891, but the earnings from it were 34 per cent. less, the average rate having fallen from 7.29 to 4.78 cents (silver) per ton per mile, or about from 4.9 to 3.2 cents in our currency, which latter is not more than one-fourth the rate on this traffic which this railroad obtained when it had the field to itself and silver was not yet depreciated. Yet the railroads which compete for this traffic—the Mexican Central, the Mexican National, the Interoceanic and the Mexican Railway—have pooled this part of their business, and their pool was in effect during the last four months of last year. The report says, however, that much freight had been engaged under previous contracts at the low rates then prevailing. The average rate on all freights on the Mexican Railway in the last half of last year was 4.36 cents silver, or about 3.25 cents gold, per ton per mile. The new Interoceanic line seems to be absolutely destroying the business of the Mexican's Jalapa line, 70½ miles, which is worked by horses, and in its best days had insignificant earnings. In the last half of 1891 its earnings were \$45,397 silver; in the last half of 1892 only \$5,913, or \$84 per mile, or \$56 gold! There have been very hard times in Mexico recently, and prosperity has not yet returned; but earnings for the first quarter of this year are 15 per cent. greater per month than in the last half of last year.

The arrangement to fund the floating debt of the Northern Pacific is one of the important financial transactions of the day. This debt is about \$10,000,000, consisting of money borrowed on time mostly, the greater part of the notes maturing in September. To meet the payment of the principal when due the company has been arranging a plan for issuing collateral trust notes at 6 per cent., running five years. The bonds of the company now hypothecated against the floating debt, together with bonds of the Calumet Terminal Co., of Chicago, and of the Chicago & Northern Pacific, as well as stocks of the St. Paul & Northern Pacific and the Northern Pacific Express Co., are to be deposited with the Farmers' Loan & Trust Co. as trustee. The special feature of the plan is that all the collateral mentioned as in the hands of the trustee is to be subject to the control of a committee of five bankers, who, subject to certain conditions, can dispose of the bonds and stocks and buy the collateral notes in the open market. After 1896 the notes can be retired by lot. The authorized limit of the notes is \$15,000,000, of which \$12,000,000 are to be issued now. Subscriptions to this amount are, it is said, practically assured.

The New York Central locomotives keep on making records. The last one was made Friday, May 19, by engine 903, hauling the Empire State express train. One run, of 81 miles, from Syracuse to Rochester, was made in 71 minutes, or at an average rate of 68.45 miles an hour. The run from Syracuse to East Buffalo, 146 miles, was made in 141 minutes, or, deducting six minutes for one full stop at Rochester in 131 minutes running time. The actual speed in motion was, for this 141 miles, 61.9 miles an hour. Between Looneyville and Grimesville, where engine 900 has made its great record, 903 made five miles in three minutes or 100 miles an hour. Engine 903 is the same size as No. 870 except that the driving wheels are 84 in. in diameter.

Bradstreet's publishes tables of gross and net railroad earnings for the month of March and for the quarter ending with March. For the month the gains in gross earnings were 6.3 per cent., and the gains in net 3.7. This was for 117 roads. But for the quarter and for 133 roads the gains in gross earnings were 2.8 per cent., and the loss in net 2 per cent. All but two of the groups, the Eastern and the Southern, fell off in the quarter.

#### A Tale of the Tariff.

BY PROXY.

While touring jauntily through the back country by rail recently, to get the benefit of the unexpired portion of a 30-ride commutation ticket that I found in the Union Depot, I combined business with pleasure by accepting an assignment from the Scale Bug Editor to furnish a two-column writeup on the daily homelife and personal habits of the *Jerseyanicus Gopherinderepest*. Although I saw several of these rare and interesting animals from the windows of the richly upholstered but poorly disinfected second-class car in which I was riding, they seemed shy and reticent in the presence of man, and I decided that I should have to draw somewhat freely on my imagination if I was to do justice to my subject.

I had been aware since leaving Hohokus that I was the object of close scrutiny by a blaze-faced man who got on at that station and took the seat opposite me. I began to feel somewhat uneasy, for it occurred to me he might be the company's detective, who was tracing the ticket I had found, or was possibly the owner of it himself. For a long time he regarded me in silence, which was broken only by the crackling sound of the fire burning rapidly through the prairie-hay Perfecto—he

bought from the peanut butcher on the train. He referred at intervals to a handy pocket-size brochure issued by the justly celebrated Mr. Duffy. The inspiration derived from this source seemed to awaken a neighborly disposition in the stranger, for presently he moved over into my seat and asked me to refresh my memory by a reference to the little work he carried, but I declined the offer.

"Scuse me, podner, ar ye a railrud man?" he asked.

I explained to him that I bitterly regretted my inability to claim that honor, but added that my wife's brother-in-law rode on a pass.

"That so? Well, look here," he continued, drawing an official looking envelope from his pocket: "I writ to the agent of the railrud fur rates on bif critters, sheep an' haugs from Hazel Baker's stockyards to Smith's Ferry. This here's his an'ser, an' as it reads a leetle bline, maybe ye kin sort of interpt it fur me."

Handing me the letter as he spoke, he leaned over my shoulder in the friendly manner common with such old boozers and followed me while I read the following letter:

TIE UP, TURN DOWN & SAW-BY R. R.

General Freight Office,  
Punky Hollow, April 1, 1893.

(Dictated.)

Mr. Hyde Bounde, Hazel Baker's Stockyards:

DEAR SIR: I have your favor of the 30th ult. requesting me to quote rates on cattle, sheep and hogs from your station to Smith's Ferry. As you neglected to state whether your shipments will consist of straight or mixed C. L. or L. C. L. lots, I shall assume that you propose to ship a certain fixed number of each and be governed accordingly. I have referred, therefore, to Transcontinental Association Eastbound Tariff No. 75, in connection with Eastern lines, effective on and after this date, in which, according to the prospectus, rates named apply to common, but I presume perfectly decent and respectable points east of the 97th meridian of longitude, with exceptions as set forth, made and provided. This work is highly indorsed by many of our most prominent railroad officials, and we, therefore, should have no hesitancy in adopting it as authority.

By it I find that the rates on live stock, C. L., freight train service only, in dollars per car not exceeding 30 ft. inside measurement (I do not understand these figures to apply to the dollar), are as follows: Horses, mules and cattle, Class A; hogs and sheep in S. D. or D. D. cars, Class C.

Assuming, therefore, that you wish to ship, for instance, L. C. L. lots of animals as above, completely K. D. boxed or crated, O. R. of chafing and leakage, N. O. S., the minimum P. P. charges would not exceed the maximum, if the bill clerk was sober. If you care, however, to take advantage of the mixed C. L. clause, where carload rates appear herein, they will apply to minimum weight of 20,000 lbs., unless otherwise stated. In this way, by shipping the hogs R. O. B., S. U. or laid down at destination, there will be no charge for demurrage, dockage or storage if cars are unloaded within 96 hours after arrival, and if no strikes, tie-ups or boycotts interfere to prevent placing of cars on delivery tracks. This term is subject to 95 hours' deduction for good behavior.

The sheep being shipped in S. D. or D. D. stock cars, weight and charges ahead and to follow subject to correction, we could issue a clean B-L if stock was S. U. C. and S. R. and G., and free from Texas fever, hoof rot and hog cholera. In other words, if the stock is loaded as billed, S. L. & C., no extra charge to be made S. O. D. or tracers for B. O. animals.

In all shipments containing asses, wild or tame, the consignor, or his agent or attorney, must give \$1,000 bonds that no animal will become idle, weak, exhausted, vicious, unruly, restive or tired or for any cause lie down; and in case of horned animals injuring each other, tampering with end doors or fighting in any way, shape or manner the expenses of a referee lie against the shipper, the company reserving the right to demand postponement of all claims 18 months, they to be then presented only at the other end of the route. Seven clear tissue copies of all line W. B's to be made by forwarding agent, and stock contracts, accident policies and requests for permits to live must be signed in quadruplicate personally or by proxy by the shipper. Rule 16 expressly states and provides that rates on commodities specified on pages 13 to 16 inclusive are specific, and must not be applied to analogous articles; that is to say, if the owner or man in charge of stock requests or requires the use of a whole car for his animals (whether one or more), he will be liable to fine or imprisonment, or both. Cars which exceed the dimensions named will not be received by lines west of the Missouri River on account of tunnels. Lighterage in New York harbor will not be absorbed except in dry weather.

In addition to the obvious advantages our line possesses over our competitors for handling your business, I am pleased to call your attention to a recent arbitrary ruling by our roadmaster, as follows:

In case of the wreck of a stock train, the sectionmen gather up the fragments of the desiccated animals with alacrity and a bushel basket, reload the same and forward to destination as hides, horns, tallow and cracklings, N. O. S., taking C. L. rates, regardless of quantity, Class B, O. R. weather, waste, decay, shortage or delay, and so receipted for, thereby saving you money.

One man in charge of stock passed free, but no return pass given. No Pullman car privileges except on the deposit of \$5 with the porter. There are several more rules and rates I could quote you, but must beg to be excused for lack of time. Drop in when you are in town and I will let you examine this tariff yourself.

I remain, very truly yours,

IRA SKINNER, G. F. A.

After carefully perusing this remarkable epistle, I was forced to admit that it was too much for me, and I turned to tell the stranger so, but he had disappeared, and so had my commutation ticket. When the conductor came around I showed him the letter, and told him I was a stock shipper, so he passed me in.\*

\*The above article will be best appreciated by those who have themselves been guilty of the form of evil-doing therein described; but the Tariff Editor, in the kindness of his heart, appends, for the benefit of the uninitiated, the following explanation of the initials used:

"C. L., carload; L. C. L., less than carload; S. D., single deck; D. D., double deck; K. D., knocked down; O. R., owner's risk; N. O. S., not otherwise specified; P. P., prepaid; F. O. B., free on board; S. U., set up; B. L., bill of lading; S. U. C., shipped under contract; S. L. & C., shipper's load and count; S. R. & G., shipper's release and guarantee; S. O. D., short, over or damaged; B. O., bad order."

On Electric Locomotives in Mines.\*

At the No. IV. pit of the Mines de Marles, near Bethune, Pas de Calais, traction by electric locomotives has been applied experimentally in two galleries, driven in opposite directions, the northern one being new, and representing more favorable conditions in regard to inclination and humidity than the southern, which is considerably older. These have been chosen in order to arrive at the conditions under which the system can be most advantageously applied. The installation supplied by the Edison company is designed to work two locomotives capable of developing 10 H. P. with a current of 30 amperes and 400 volts, and utilizing 70 per cent. of that given out by the dynamo. The engine with cylinder of 400 millimetres (15 1/2 in.) diameter, and 800 millimetres stroke, making 65 revolutions per minute, drives the dynamo by means of a belt at 840 revolutions. The main conductors on the shaft are insulated cables of copper, 9 millimetres (0.35 in.) diameter, supported on porcelain belts at intervals of 30 metres, which are connected with a switchboard at the pit-bottom for turning the current either to the north or south gallery as required. The conductors in the gallery are flange rails weighing 6 1/2 kilogrammes per metre (13 lbs. per yard), which are hung from the roof and insulated by discs of india-rubber.

The locomotive is a 15,000-watt series dynamo, mounted on an iron carriage with two axles, which are driven by an intermediate shaft and toothed gearing, the axis of the dynamo being parallel to the road. The current is taken from the conductors by two small carriages drawn by the locomotive. The electromotive force, and consequently the power of the engine, may be varied by a rheostat placed in the circuit, which acts upon the magnetic field of the main dynamo, so that it is very easily controlled. There is also a quick-acting disconnecting gear at either end for admitting or cutting off the current for the locomotive, as well as a reversing gear by changing its direction. The dimensions are: Length, 2.30 metres (7.54 ft.); breadth, 0.72 metre, and height, 1.50 metres. The weight, which was originally 1,800 kilogrammes, being insufficient for the south gallery, where the adhesion is deficient, it has been increased by the substitution of solid wheels and counterpoises to 2,300 kilogrammes, which is found to give perfect adhesion and stability. The loss of current on the line is imperceptible.

In order to determine the mechanical efficiency of the arrangement a series of experiments have been made on the southern gallery on a length of 400 metres, with a rise of 1 deg., with the engine alone, and with trains of variable lengths, running at different speeds, with the regulator open or shut. The figures obtained are given in detail and an abstract of the results in the following table:

Experiment.	Moderator.	Tubs in train.	Speed per second.	H. P. of surface dynamo.	Effect in H. P. including locomotive.	Useful mechanical effect.	Useful industrial effect.	Weight.
No.						Per cent.		Kilograms.
1	Shut	2.50	10.86	3.06	27.00	.....	.....	2,370 (engine only)
2	Open	15.23	19.33	11.30	58.50	43.38	.....	3,660 (train without engine)
3	Open	12.34	18.21	14.00	77.00	54.48	.....	2,950
4	Open	12.25	17.37	10.00	57.50	40.70	.....	2,950
5	Shut	4.19	13.96	3.37	24.07	12.46	.....	1,217
6	Open	8.30	16.14	10.00	61.95	38.56	.....	2,004

By useful industrial effect is meant the work of moving the train apart from the engine. The effect of the moderator is only to limit the quantity of current, but not to regulate it. When closed, as on the first and fifth experiments, the current varies from 16 to 20 amperes; and when full open the quantity is the same, the difference of work being due to the voltage. In the fourth and sixth, with three-quarter open, there is a reduction from 30 to 25 amperes. This is due to the self-regulating character of the locomotive, which varies the expenditure of power with the work to be done. It is therefore a point of importance to keep the gradient of the line as uniform as possible, in order that the current may never exceed the maximum that can be safely borne by the rheostat. A comparison of the second, third, fourth and sixth experiments shows that it is better to increase the speed rather than the load. Electric machines work best at high speeds. In the third and fourth experiments the speed is seen to be increased 40 per cent. with the same load, while the extra power expended is only 5 per cent., the maximum useful effect being obtained at a speed of 3.46 metres. This, however, is likely to be too high, except on straight roads of greater length, free from crossings and the conditions of the second experiment. The engine drawing fifteen tubs at 2.50 metres (9 kilometres per hour) speed will probably be more suitable. At this rate the engine could furnish in coal drawn 243 ton-kilometres in the shift of eight hours. With horse-traction, having regard to the bad state of the road, five horses (four at work and one relief) will be required to do the same amount of work. The two locomotives, therefore, when in full work, the only conditions under which they can be profitably employed, will replace ten horses. The working cost being £1 12s. 10d. in the first case and £2 17s. 6d. in the second, there is a difference of 42.5 per cent. in favor of the electric method of transport.

A further considerable advantage is likely to be obtained by the use of the line for traveling by the miners. When the working faces are 2 kilometres from the pit-bottom, half an hour will be saved by carrying the men to and from their work, allowing an increase of working time of 1/6, or 6 per cent., or fifty full shifts on the eight hundred men employed underground.

The cost of the installation has been:

Steam engine.....	£ s. d.
Steam pipes and other accessories of erection, etc.....	422 10 0
Dynamo at the surface.....	243 15 4
Insulated conductors, 630 metres.....	197 7 6
Erection of electrical arrangements and sundry charges.....	72 14 0
	132 5 0
Total of fixed plant.....	1,068 11 10
1,400 metres of electric line, materials and laying.....	319 4 0
Three locomotives.....	750 0 0
Total.....	2,137 15 10

\* From "Abstracts of Papers," Institution of Civil Engineers.

TECHNICAL.

Manufacturing and Business.

The Canton Steel Roofing Co., Canton, O., which lost its entire plant and offices by fire on Dec. 7 last, reports that it is now located in its new factory, which is much larger than the old one, and the works are running night and day. The factory has been equipped with the latest and best machinery known for turning out a full line of sheet metal goods for buildings, and the company is now able to fill all orders promptly. Sales are reported larger so far this season than ever before. The exhibit at the World's Columbian Exhibition is located in the northwest corner of Manufactures and Liberal Arts Building, section H.

The following Board of Directors has been elected for the Electric Selector & Signal Co., of 45 Broadway, New York: Jennings S. Cox, John Dougherty, James Brown Potter, Charles F. Homer, J. M. Townsend, Jr., W. E. Tillinghast, Thomas Sturgis, W. C. Lane, F. P. Voorhees and C. P. MacKie; the officers are: Thomas Sturgis, President; W. C. Lane, Vice-President; C. P. MacKie, Vice-President and General Manager; F. P. Voorhees, Treasurer; J. B. Potter, Secretary, and S. S. Bogart, General Agent.

The plant of the United States Rolling Stock Co., at Hegewisch, Ill., was sold at public auction on May 22. The sale was on the suit of the Central Trust Co., of New York, to foreclose a first mortgage of \$250,000. The price paid by the reorganization committee, which was the only bidder, was \$350,000, subject to mortgage of \$250,000. The plants at Anniston and Decatur, Ala., and Urbana, O., have been previously bid in by the committee.

The Hinson drawbar attachment is being applied to 1,000 cars which are being built for the Boston & Albany, 700 at the South Baltimore Car Works, and 300 by the Jackson & Woodin Manufacturing Co.

The following companies were incorporated in Illinois this week: Adams Car Co., Chicago; capital stock \$500,000; incorporators, Frederick U. Adams, Robert W. Hamill and Charles H. Hamill; the Strictly Automatic Gate & Fence Co., of Winchester; incorporators, H. P. Levis, Wiley M. Gresham, Charles Little; the Western Engineering & Construction Co., Chicago; incorporators, William E. Traver, George B. Collins, George A. Manwaring.

The Page Woven Wire Fence Co., of Adrian, Mich., has received a contract for erecting about 25 miles of wire fence on the West Shore road and several miles on Ulster & Delaware road.

The Perfected car coupler will hereafter be known as the National car coupler and will continue to be controlled by Mr. J. A. Hinson, of Boston.

After three months of more or less embarrassment on account of a fire that partially destroyed the factory of the company, the Ashton Valve Co. announces the complete reopening of its plant. New engines together with new boilers, one of which is built for a working pressure of 300 lbs. per square inch, have been installed. With increased power, excellent testing facilities and improved machinery, it is prepared better than ever to increase its production and maintain a reputation for manufacturing the highest grade of goods made.

The Buffalo Forge Co. has contracts for the heating and ventilating plants for the new Methodist churches in Pittsburgh and Allegheny, Pa., these churches being the largest church buildings in either city. The heating apparatus consists in each instance of 12-ft. fans and heaters containing 6,000 ft. of 1-in. pipe. The apparatus is so built that it can be used as a cooling machine in summer, as well as a heating and ventilating plant combined during the cold weather. Arrangement is further provided that during the moderate weather hot air and cold air can be mixed together. The machinery and materials employed in the heating and ventilating plant for the above buildings constitute more than two car-loads.

New Stations and Shops.

The New York Central & Hudson River Railroad will begin work next month on two new stations at Woodlawn and Bronxville, N. Y., on the Harlem Division. The Bronxville station will be of native stone and exquisite in design and finish.

The Cruiser "New York."

The United States cruiser "New York" made her trial trip for speed last Monday and steamed over a measured course of 82.65 knots at an average speed of 21.07 knots an hour, earning for the Cramps, who were the builders, a premium of \$200,000. It is reported that the highest steam pressure carried was 180 lbs., and the greatest speed of the engines 138 revolutions. The average engine speed was about 135 revolutions. An official dispatch from the navy department says that the machinery worked beautifully.

"Christopher Columbus."

The new whaleback passenger steamer "Christopher Columbus," built by the American Steel Barge Co., of West Superior, and described in the *Railroad Gazette* of Dec. 9, 1892, reached Chicago on the 11th inst. This boat is to be used by the World's Fair Steamship Company for the transportation of passengers between the Van Buren street pier and the grounds of the World's Fair. The capacity of the boat is about 5,000 passengers, and it is expected that the run between the city and the

grounds can be made in about half an hour. The boat is said to have shown unexpected speed in the trip from West Superior to Chicago. Her engines are triple expansion, with cylinders 24, 42 and 70 in. in diameter.

Park Avenue Improvement.

The contracts for building the elevated railroad of the New York Central between 110th and 134th streets, New York City, as described in our last issue, were awarded by the Board on May 18. These contracts, which are only for the metal structure and not including the track rails, were awarded, three sections to the Elmira Bridge Co., and one section to the New Jersey Steel & Iron Co. The prices for each section, as stated in our article of last week, were as follows: Elmira Bridge Co., Section 1, \$373,000; Section 2, \$344,000; Section 4, \$425,000; New Jersey Steel & Iron Co., Section 3, \$333,000. The Elmira Bridge Co.'s contract aggregates 5,326 linear ft., and the New Jersey Steel & Iron Co.'s is 1,083 ft. long.

The Multiple Speed Railroad.

The Pier Movable Sidewalk Company, of whose plant at the World's Fair a description appeared in the *Railroad Gazette* of May 12, has as yet been unable to get from the Exposition Company the power necessary to run its endless train. This was promised by April 15, it being thought advisable to run for a few days without the flexible rail and top platform, and so limber up the train. It is expected that power will now be available within a very few days, so that the company will be able to make preliminary tests and get the plant in operation by the time the increase in attendance creates the expected demand for this service.

The New York Brake and Coupler Laws.

The coupler and brake laws recently passed by the New York Legislature, and approved by the Governor on May 2, require the universal use of the Master Car Builders' type of coupler on freight cars in four years and eight months, and of continuous power brakes on freight trains in nine years and eight months. The provisions of the law are briefly as follows:

Chapter 543. Section 1. It shall be unlawful to use an engine without driving wheel brakes and appliances for operating a train brake after Jan. 1, 1895. Section 2. Ten per cent. of all freight cars owned or operated must be equipped with power brakes every year; coal jimmies are excepted, and after Jan. 1, 1898, it shall be unlawful to use them under a penalty of \$100 for each offense. Section 3. After Jan. 1, 1903, it shall be unlawful to use a car without power brakes operated from the engine. Section 4. The railroads must file with the Railroad Commissioners annually, for 10 years, a verified statement of cars equipped and unequipped. Section 5. After Jan. 1, 1903, there will be a penalty of \$100 for each freight car not equipped. Section 6. The Railroad Commissioners may, after full hearing and for good cause, exempt any company as to the 10 per cent. requirement in any particular year, and may extend the time for compliance with the law, but not exceeding five years from Jan. 1, 1898.

Chapter 544. Section 1. From the passage of this act every new freight car shall be equipped with couplers of the M. C. B. type. Section 2. Twenty per cent. of all freight cars except coal jimmies must be equipped each year. The use of coal jimmies shall be unlawful after Jan. 1, 1898; penalty \$100. Section 3. The use of any freight car not equipped with M. C. B. couplers shall be unlawful after Jan. 1, 1898. Section 4. Railroads must file annual statements, as in the preceding chapter, but for five years instead of 10. Section 5. The use of cars unequipped after Jan. 1, 1898, involves a penalty of \$100 for each offense. Section 6. The Railroad Commissioners may extend the time for compliance, the same as in the preceding chapter, but not exceeding five years from Jan. 1, 1898.

The New Orleans Bridge.

The site for the bridge over the Mississippi river at New Orleans has been selected by the bridge company and approved by the War Department. It is a little above what is known as Twelve Mile Point, about 15 miles by the river above the head of Canal street, New Orleans, and five miles above the upper limits of the city.

New York & Brooklyn Bridge.

The tenth anniversary of the opening of the New York & Brooklyn Bridge was marked Wednesday by a display of flags on the summits of the towers. In the ten years the receipts of the bridge from all sources have been about \$10,000,000. Of this about one-half has been spent in maintenance and the other half in improvements. The original cost of the structure was \$15,000,000, and the total cost up to the present time about \$20,000,000. There have been a total of about 280,000,000 passengers carried in the cars since the railroad was put in operation, the number increasing from 8,000,000 in 1884 to over 40,000,000 last year. The car-fare was five cents at first, but was reduced to half this sum a few years ago. Foot passengers were originally charged a cent, and later one-fifth of a cent, but in 1891 the promenade was made free. Before that time about 3,000,000 people walked over the structure each year, and it is supposed that the number has been greater since, although a record can be kept, making a total of about 40,000,000 who have walked across the bridge. The earnings of the roadway from tolls, now only one-half of what they formerly were, are about \$80,000 a year. From carfares over \$1,250,000 was received last year.

Interlocking and Pneumatic Signals.

The New York Central is putting in electro pneumatic interlocking at the west leg of the Y at Mott Haven Junction, New York City, where the Hudson River division joins the Harlem division. This tower is but a short distance from the power-house which furnishes compressed air for the pneumatic signals on the Harlem division, and will derive its power from

that source. The signals here have heretofore been operated by mechanical interlocking.

The New York Central is erecting overhead bridges to carry the block signals at numerous points on the four-track portion of the Harlem division, between Mott Haven and Woodlawn, and on the Hudson River division between Spuyten Duyvil and Yonkers. The right of way is so narrow at many places on these lines that the signals, when placed on brackets at the side of the road, as at present, are partially obscured by the telegraph poles and wires.

The Union Switch & Signal Company has a contract for automatic block signals on the Lake Shore & Michigan Southern.

#### Rapid Transit in New York.

New York's remarkable rapid transit commission has again succeeded in bungling matters and indefinitely stopping any real progress. There is, however, one great compensation for this last exploit; it will probably give employment to a number of engineers laying out the new lines, and there are lots of them who need it.

#### THE SCRAP HEAP.

##### Notes.

The Order of Railroad Telegraphers held its annual meeting at Toronto last week. D. G. Ramsay was re-elected Chief.

The Railway Employes Club of Minnesota held its annual meeting at St. Paul, May 16, 106 delegates being present. F. M. Dunn, of Minneapolis, was elected President.

The Railroad Commissioners of Missouri have made an inspection of the Quincy, Omaha & Kansas City road and report that from Kirksville to Trenton the rails are insufficiently spiked.

A special train on the Delaware, Lackawanna & Western, carrying President Samuel Sloan, ran from Hoboken to Buffalo on May 16 in 8 hours and 25 minutes. The distance is 408 miles.

The Union Pacific shops at Starbuck, Wash., were burned on the night of May 17, together with the roundhouse, 13 locomotives and other property. The press dispatches estimate the loss at \$300,000.

A fire at the King Bridge Co.'s shops at Cleveland last week destroyed shop No. 1, in which the riveting department was situated. The power plant, machine shop and forge department were, with very slight exception, uninjured and are running as usual. The firm expects to complete the contracts it has on hand promptly, and any new ones it may obtain. The company will at once commence the construction of an entirely new riveting department which will be of fireproof construction.

##### Lake Notes.

The whaleback passenger steamer "Christopher Columbus," which is to carry passengers from Chicago to the Fair, made a spurt of 30 miles on Lake Superior, coming down, in one hour and a half.

The fleet of vessels bound to Ft. William, after fighting the ice for over a week, got through it on the 20th inst., to find that a bar had formed at the entrance of the harbor with only 12 ft. of water on it. As the vessels are loaded to 14 ft. they cannot get in until a channel is dredged.

The steel passenger steamer "Manitou," of the Lake Superior line, was launched from the Chicago shipbuilding yard at 101st street on the 19th. She is 295 ft. long, 42 ft. beam, and 32½ ft. depth from the hurricane deck. Completed cost, about \$300,000. She is to be run between Chicago and the Sault Ste. Marie, making two trips a week.

The first shipment of wheat from Duluth to Chicago arrived at the Windy City on the 19th, in the steamer "Gratwick," freight 3 cents per bushel. Heretofore much flour has been shipped from Chicago to Duluth, and on the occasion of corners wheat has been shipped from Milwaukee and even back from Buffalo, but this is the first shipment from Duluth to Chicago.

##### Canadian Canals.

The Chief Engineer of Canals for the Dominion Government states that he expects the new Canadian "Soo" Canal will be ready for opening in September. He says that experiments in opening lock gates by electricity are now being made on the Beauharnois Canal, and if successful the lock gates of the "Soo" Canal will be operated in the same way.

The Kingston Locomotive Works, Ontario, are shipping three locomotives to contractors for use on the Soulages Canal, Ontario, and have received an order for a fourth. One of these locomotives is for an American contractor, Charles H. Rayner, of Syracuse, N. Y., for whom they have also completed 30 dump cars.

##### Fact and Opinion Out West.

A railroad man, that is a conductor or brakeman, sometimes makes from 15 cents to \$10 extra by collecting fares in box cars from gentlemen who are not hankering after notoriety, but who are going from one settlement to another as quietly as possible so as not to get their names in the paper. A dollar will carry a man a long way in a box car, although it does not give him the privilege of suing the company in case of an accident. Well-regulated crews divide the train into two equal parts. The head brakeman has the first half of the train, the hind brakeman has the latter half, and the conductor gets the caboose fares, which he sometimes divides with the company, but conductors have been discharged for being too honest in that respect; trainmasters, superintendents and general managers have most of them commenced by carrying water to the section crews, and wound their way up on the brakeman and conductor ladder, and they don't like to see old landmarks destroyed or adulterated.—*Grafton (N. D.) Record.*

##### The Consumption of Rails in France.

The following little table gives the quantities of rails ordered by the French railroads from French mills in the respective years. The quantities are in "tonnes" of

2,204.6 lbs. The table is from the *Journal des Transports*:

1869	183,628
1870	217,546
1871	208,553
1872	311,334
1873	284,631
1874	249,416
1875	170,585
1876	108,896
1877	9,898
1878	58,046
1879	66,844
1880	112,857
1881	163,840

The price per "tonne" was 150 francs in 1892.

##### Two Cranks.

An English contemporary points with pride to the old engine "John Bull," which recently ran from New York to Chicago under steam as "a striking example of that durability which has rendered British manufacturers so famous in every clime." Another crank replies that the Englishman should remember that the "John Bull" was built before England had free trade.

##### Suez Canal Statistics.

A Parliamentary paper has been issued giving the traffic returns for 1892. The number of vessels that passed through the canal, their tonnage, and the receipts in the last three years are as follows:

Year.	Vessels.	Gross tonnage.	Net tonnage.	Receipts.
1890	3,559	10,866,401.468	7,712,028.61	74,452,436
1891	4,207	12,217,986.41	8,698,777.56	83,121,101
1892	3,389	9,749,129.09	6,890,094.41	66,981,600

The percentage of vessels and of gross tonnage of the countries that took the chief part in this navigation stand thus:

	1892.		1891.		1890.	
	Ves-	Gross	Ves-	Gross	Ves-	Gross
	sels.	ton-	sels.	ton-	sels.	ton-
		nage.		nage.		nage.
Great Britain	72.52	74.56	76.47	77.63	74.42	76.30
Germany	8.20	7.44	7.56	7.12	8.11	7.51
France	4.89	5.85	4.07	5.05	4.99	5.70
Holland	4.97	3.99	3.49	3.49	4.25	3.51
Italy	2.18	1.82	2.76	2.36	2.57	2.23
Austria-Hungary	1.71	1.76	1.21	1.39	1.62	1.83
Norway	1.85	1.35	1.31	0.93	1.27	0.80
Turkey	1.21	0.61	0.95	0.49	0.62	0.29

No other country reached one per cent. The number of ships belonging to each country which passed upwards of 100 vessels in 1892 was:

Great Britain	2,581
Germany	292
Holland	177
France	174

The next largest numbers were Italian 74, Norwegian 66, and Austro-Hungarian 61. The working of the canal continues to improve, and the time occupied in the transit was further reduced to a mean duration of 21 hours 16 minutes in 1892; 90 per cent. of vessels navigated by night. The most remarkable circumstance in the returns for 1892 is a considerable increase in Dutch merchant vessels, while the traffic of other nations either slightly decreased or was stationary. The English percentage of traffic was 72.52 in 1892, as against 76.47 in 1891.—*The Economist.*

##### Fatal Train Accident in Ireland.

A press dispatch from Dublin, May 22, reports the killing of five and the serious injury of 12 passengers by the wreck of a runaway train. The disaster was on the Tralee & Dingle Railroad, which, according to the directories, is a light railroad built under the Tramways act. The engineman lost control of the engine and the train ran at high speed halfway across a viaduct on a curve and then jumped the track, falling 50 ft.

##### Exports of British Locomotives.

The following table shows the value of the locomotives exported from the United Kingdom during the first quarter of the present year, as compared with the corresponding periods of the past two years:

	1891.	1892.	1893.
Germany	\$4,572	\$1,758	4998
Belgium	185	917	
France	585	1,161	5,347
Spain and Canaries	15,480	6,161	3,893
Other countries in Europe	48,531	40,896	4,746
United States	8,994	537	11,377
Countries in South America	132,105	45,519	43,538
British possessions in South Africa	38,478	1,390	910
British East Indies	81,293	61,163	106,820
Australasia	51,262	65,893	43,368
Other countries	35,588	14,472	17,625
Total	417,073	239,867	238,592

It will be seen that the exports during the past quarter, while being about the same as those during the corresponding period of last year, show a falling off of about 43 per cent., as compared with the corresponding quarter of 1891. A striking feature is shown in the case of our exports to the United States, which show a large increase. This is the more striking as it is that country which has offered the keenest competition to Great Britain as regards the supply of locomotives to foreign countries. The United States is at present paying great attention to the requirements of South America. To this the decreased value of the exports of locomotives to South American countries from this country, as shown in the above table, may in part be attributed. The exports to South Africa also show a great falling-off. Railway construction in that country is still being actively carried on, so that locomotives should still be in demand there. We trust therefore that our manufacturers will not let foreign builders step in and secure the orders.—*Industries.*

##### The Pennsylvania Elevation at Elizabeth.

Considerable progress has been made during the past two weeks on the work on the Pennsylvania elevation at Elizabeth, N. J. At the Pearl street crossing the grading has been completed under the trestle, and Burnet street, which runs parallel to the railroad, is being graded down to Pearl. Rahway avenue is being graded down on the west side of the tracks, and as Cherry street and Rahway avenue are both temporarily closed the proposed new street between them has been opened under the trestle. At the Broad street-Morris avenue crossing the foundation for the north abutment wall has been completed. The excavation for the foundation for the centre pier of the North

Broad street arches is finished on the north side and the first course of stone is laid. Excavation has also been begun for the north side of the pier between the Central of New Jersey tracks and the North Broad street arches. The railroad company having bought the property for 250 ft. down East Broad street, it has torn down all the buildings except the one used as the company's office. The site will probably be occupied by the new passenger station. Since all trains have been running over the elevated tracks the railroad company has graded the crossing under the trestle at Chestnut street and thrown this street open for travel.

##### San Francisco Union Station.

The Harbor Commissioners of San Francisco, last week, opened bids for the construction of the foundation for the new ferry buildings at the foot of Market street. The contract was awarded to the San Francisco Bridge Co., for \$247,887, the lowest bid. There were eight bids, as follows: Bigelow & Fogg, \$340,000; California Bridge Co., \$337,767; Doe, Hunt & Co., \$297,000; McCann, McKay & Phillips, \$290,000; McMahon & Son, \$295,000; Cotton Brothers, \$317,227; and Healy, Tibbets & Co., \$309,000. The San Francisco Bridge Company's bid was over \$40,000 under that of the next lowest bidders.

##### Brazilian Railroads.

The report for 1892 of the Alagoas Railroad Co., operating in the State of Alagoas, Brazil, shows a continued increase of traffic. The number of passengers has grown from 71,782 in 1891 to 105,410 in the past year. Freight also increased from 34,038 tons to 52,495 tons. This is due in large part to the influence of a new feeder, the Assembleia branch, which was opened to traffic a little more than a year ago. The operating expenses, however, showed a disproportionate increase, reducing the net income correspondingly, the trouble lying in the low rate of exchange, which enhanced the cost of supplies, and necessitated an increase in wages to employees. The company is now proposing to raise the freight and passenger rates to meet this difficulty. About two years ago all rates were reduced, which resulted in so reviving commerce in the state as to earn for the road the first substantial dividend it had ever been able to declare.

In spite of rumors of wars in Rio Grande do Sul, Brazil, law and order seem to have prevailed, to the material encouragement of commerce in that region, as appears from the fact that the earnings of the Port Allegre & New Hamburg Railroad were \$102,175 in 1892, against \$85,522 for the preceding year. The passengers carried increased from 63,377 to 71,851, and the freight traffic, exclusive of express business, grew from 18,733 tons to 21,245 tons. Business on this line has been steadily growing, the traffic for 1891 having been 22½ per cent. in excess of that for 1890. The Southern Brazilian Railway, also located in Rio Grande do Sul, has shown similar gains in traffic, the increase, for example, having been from \$43,300 in January, 1892, to \$54,000 in January 1893. This road, which is now open for a distance of 175 miles, is being rapidly pushed to completion, and will then extend 290 miles into the interior of the state.

##### CAR BUILDING.

The Columbia Coal Co., of Philadelphia, is in the market for 500 cars.

##### BRIDGE BUILDING.

Ashtabula, O.—The County Commissioners have decided in favor of the location at Bank street for the proposed high-level bridge across the Ashtabula River to the East Side. This action does not pledge the Commissioners to the erection of this bridge. The estimated cost of the structure is \$70,000, and before taking any further action they ask that \$25,000 of the cost be raised by a private subscription, and that the city shall also aid in the erection of the bridge.

Cincinnati, O.—The plans for rebuilding the Ohio River bridge at Newport have been accepted by Superintendent Ralph Peters, of the Pennsylvania, and work will now be proceeded with at once. The bridge is owned by the Newport & Cincinnati Bridge Co., which is controlled by the Pennsylvania. The bridge was opened in 1872, and it is now proposed to rebuild the iron superstructure on the present masonry. The Secretary of War has approved the plans to provide for a channel span of 413 ft., the bridge to be 103.7 ft. above low water mark. The new superstructure will carry two railroad tracks, a street railroad track, a wagon-way and footwalk. The cost of rebuilding the bridge will be about \$600,000.

Macon, Ga.—The grand jury of Bibb county have recommended the building of an iron bridge over the Ocmulgee River at First street, in Macon. They also recommend that the County Commissioners order an election on the question of voting \$80,000 of bonds for building the structure. The estimate prepared by Engineer Hamlin, of Chattanooga, is for a bridge to cost about \$21,000.

Narrows, Ont.—R. B. Rogers, Superintendent of Trent Navigation Works, is preparing plans for the bridge at the Narrows. The bridge will be a steel structure, with piers and abutments of masonry. Its swing will be two spans of 45 ft. each, while the stationary portion will be about 150 ft. in length. The entire structure, including approaches, piers and swing, will be about 300 ft.

New York City.—Adrian H. Joline, Samuel W. Milbank and Thomas L. James have been appointed by the General Term of the Supreme Court commissioners to take testimony in the proceedings of the East River Bridge Co., to acquire property for bridge approaches and for a connecting line of elevated railroad in New York. The commissioners will appraise the property the company proposes to take under its charter.

Ottawa, Ont.—The Pontiac Pacific and the Ottawa & Gatineau Valley railroads have decided to unite in the construction of the long bridge which is to span the Ottawa River at this point. The shareholders will at once be asked to agree to issue bonds for the cost of the bridge. The estimate for a railroad bridge is \$500,000 and for a combined railroad and highway bridge \$750,000.

Pend d'Oreille, Wash.—A full train load of steel arrived in Spokane, Wash., last week over the Northern Pacific for the Spokane & Northern bridge over the Pend d'Oreille River. The California Steel Bridge Co. has the contract for construction, and the castings were made by the Dominion Bridge Co. at Montreal. It will be a cantilever steel structure.

**Spokane, Wash.**—The plans and profiles for the new Post street bridge have been completed by the City Engineer and are in the hands of the Board of Public Works. The City Council will probably instruct the Board of Public Works to advertise for bids at its next meeting.

**Welch, W. Va.**—L. B. Henritze, W. G. Hunt and D. H. Harman, Jr., have been appointed by the County Court of McDowell County, West Virginia, to ask for bids for building a new highway bridge over Elkhorn River at the foot of McDowell street at Welch.

## RAILROAD LAW—NOTES OF DECISIONS.

### Carriers of Goods and Injuries to Property.

The Supreme Court of Missouri holds that where a railroad, in a bill of lading for the shipment of cotton, reserves the right to have it compressed, and afterwards places it in the hands of a compress company for that purpose, such compress company becomes the agent of the road, and, if the cotton is damaged or destroyed by the negligence of the compress company, the railroad company is liable to the owner.<sup>1</sup>

The Federal Court rules that the right of action existing at common law in favor of the shipper for extortionate charges was superseded by the law of 1887 which entitles the shipper to recover triple damages from the carrier for exacting unreasonable and unjust freight charges.<sup>2</sup>

In Kansas the Supreme Court rules that under the statutes which make railroad companies liable for stock killed unless the road is inclosed by a good and lawful fence to prevent animals from being on the track, the fact that there is a traveled wagon road running parallel with the railroad, but a sufficient distance from the track to permit the construction of a fence, does not excuse the company from inclosing its road with a good and lawful fence.<sup>3</sup>

In Indiana it is held that the fact that plaintiff permitted his horse to follow him on to defendant's right of way is not an abandonment of the horse by plaintiff which will prevent a recovery for its death, where it had afterward followed him from the right of way on to the highway, a safe distance from the track, but had again entered it, because frightened by the approach of a train, at a point which defendant had failed to fence.<sup>4</sup>

In Nebraska it is laid down by the Supreme Court that where a locomotive engineer, in a city where teams are constantly passing, needlessly opens the valves of his engine, and permits the steam to escape, whereby plaintiff's horses are frightened and run away, doing injury, the company is liable.<sup>5</sup>

### Injuries to Passengers, Employees and Strangers.

In New York it is held by the Supreme Court that the sale by a railroad company of a through ticket to a point beyond its own line renders it liable to the passenger for the destruction of his baggage while on the line of a connecting road, though the ticket is a coupon ticket specifying that the company selling it is agent for the connecting roads, and limiting its liability for damages to such as occur on its own road, since the original sale of the ticket makes the contract, and the passenger is not concerned with private arrangements entered into between the companies for the purpose of keeping track of their business.<sup>6</sup>

In Texas it is held by the Supreme Court that it was error to charge that carriers are held to the greatest possible care for the safety of their passengers. They are not insurers of the absolute safety of their passengers, but are required to provide for their safe conveyance as far as human care and foresight will go; "and their duty extends to the providing of good and sufficient material, the employment of skilled engineers, correct methods in the original construction, inspection and subsequent maintenance in repair of its road, embankments," etc., "and of the engines and cars which it uses, and the speed of its trains. . . . and a failure of duty in any of these respects renders defendants liable." The charge of the lower court imposed too great care on defendants as carriers of passengers.<sup>7</sup>

In Texas it is laid down by the Supreme Court that the mere fact that a person rides on the platform of a train to avoid paying his fare does not deprive him of the right to become a passenger if he pays the regular fare when demand is made, and commits no breach of the peace; and where, in such case, the conductor of the train, before demanding fare of such person, assaults and ejects him from the train, the company will be liable for any injuries he may sustain.<sup>8</sup>

In Indiana the plaintiff purchased a ticket over defendant's road, entitling her to passage on its train to one of its stations, but the train carried her a quarter of a mile beyond her destination, and against her objection the conductor ejected her at that point, and she was obliged to walk back to her station, from which exposure she became sick. The Court rules that defendant was liable for damages for breach of contract.<sup>9</sup>

In Indiana a section hand in the employ of defendant was, while propelling one of its hand cars, thrown therefrom by the breaking of the car handle, which was defective, and sustained injuries from which he died. The defect was not patent and was not known to plaintiff's intestate, and was only known to one of defendant's employes—the carpenter who made the handle. The Supreme Court rules that his knowledge was not sufficient to bind defendant with notice of such defect, and, it appearing that defendant had provided a competent inspector to see that suitable appliances were furnished its employes, no action would lie for the death of plaintiff's intestate.<sup>10</sup>

In Alabama, in an action by an employé for injuries caused by a car standing dangerously close to the track on which his train was passing, it appeared that the car was so placed to suit the convenience of the consignee in unloading, which he wished to do on the ground and in the street; that the consignee owned a building by the spur track on the opposite side of the street, with a platform for loading and unloading cars, where the car could well have been placed. The Supreme Court rules that there was no such necessity for the car being left in its dangerous position as would relieve defendant from liability for placing it there.<sup>11</sup>

The Supreme Court of Alabama holds that a movable object, such as a car on a side track, placed temporarily in dangerous proximity to a railroad track, is not a defect in the "ways" of the company within the meaning of the statute making a master liable to an employé for injuries occasioned by such defect.<sup>12</sup>

In Missouri, in an action against a railroad for the death of plaintiff's decedent, employed in defendant's tunnel, the petition alleged that the tunnel, because the fan that ventilated it was out of repair, was in a "dan-

gerous condition," being filled with "steam, smoke, and noxious gases," and that defendant, though well knowing this fact, negligently ordered decedent to go into the tunnel, whereby he was "choked, strangled and killed." The evidence showed that about the time decedent went into the tunnel there were but few trains passing through; that shortly after, his fellow-servant went into the tunnel and experienced no difficulty in breathing; that the tunnel had been used for a long period of time without a fan, and no one was ever suffocated while working in it; and that decedent, when found, lay near the track, and had been struck by an engine. There was no evidence showing the existence of noxious gases in the tunnel, or that the smoke and steam were sufficiently dense to endanger decedent's life. The Supreme Court holds this insufficient to warrant a submission to the jury, no negligence being shown on the part of defendant.<sup>13</sup>

In Alabama the Supreme Court holds that the danger in coupling cars with differently constructed couplers and bumpers is an obvious danger, and it is not negligence to fail to instruct a brakeman not familiar with the service as to such danger.<sup>14</sup>

In Michigan the company maintained a plank sidewalk across its track at a street crossing. The plank next to one of the rails had become split, leaving a space between the rail and the plank sufficient to admit a person's foot. Plaintiff caught his foot in this place, was unable to extricate it, and was run over by defendant's train, losing both his feet. Defendant's track hands admitted that if the plank had been examined the defect would have been readily seen, and there was no claim that any particular examination had been made for six years prior to the injury, except such as could be made by the track hands passing on a hand car. Some of defendant's witnesses testified that the planking next the rail would be nearly used up by the passing trains in about six months. The Supreme Court holds this sufficient to charge defendant with liability for the defect in the planking.<sup>15</sup>

In the Federal Court of Appeals some children playing near a railroad track within the limits of a town placed pins upon the rail, and then ran into some bushes. The persons in charge of the train intended to make a "flying switch," and the train was cut in three sections, the conductor pulling the pin between the first and second section, and then immediately going to the rear of the first car of the second section to man the brake. After the first section had passed, the children ran out from the bushes, and one of them, while stooping to pick up the pins, was struck by the second section, the conductor being unaware of his presence. The place of the accident was within the limits of a street which, according to the plat of the town, here crossed the track, but the street had not been opened for vehicles, and was only used by pedestrians. The Court rules that the court properly refused to direct a verdict for defendant; for the failure to have a lookout on the front of the second section tended to show a want of proper care.<sup>16</sup>

In Kansas it appeared that deceased was 70 years old at the time of the accident, and in full possession of his faculties of sight, though slightly deaf; that in attempting to cross one of defendant's side tracks he discovered cars coming toward him, jumped back, and was struck by cars coming down the main track in the same direction; that at the time he was crossing, three cars were detached from the engine and "kicked" down on the main line and two on the side track, and that the cars on the side track were a car length ahead of the cars on the main track. The accident happened in the afternoon, the day was clear, and the main track straight for a long distance. The Supreme Court holds that defendant was guilty of contributory negligence, and could not recover.<sup>17</sup>

In New York the plaintiff's intestate was killed while driving over defendant railroad's crossing. Two years prior to the accident, defendant had placed at such crossing an automatic bell, to give warning of approaching trains. After a year's trial it was abandoned as a failure, but was allowed to remain at the crossing. From the time the bell was placed at the crossing, plaintiff's intestate, in the course of his business, met the trains at such crossing daily. It was held that he must be assumed to have known that the presence of the bell indicated nothing, and, as regards him, failure of the company to remove the bell was not negligence.<sup>18</sup>

The Supreme Court of Texas holds that a railroad in the hands of a receiver is not liable for personal injuries resulting in death caused by negligence of the Receiver.<sup>19</sup>

In Michigan the Supreme Court rules that where a railroad, on the notification of the common council of a village, has constructed a foot crossing where its track crosses a street, and for years has kept it in repair, the company has by this act invited people to pass over the walk, and it has thus become its duty to keep such walk in a reasonably safe condition for public travel.<sup>20</sup>

In the Supreme Court of the United States the plaintiff's intestate, without permission, and without paying fare, climbed upon a coal train to ride through a tunnel, placing himself upon the end of a car, with his feet hanging between that and the adjoining car. From this position he was thrown between the cars by a sudden jerk, and received injuries from which he died. It is held that the railroad company was not liable in damages.<sup>21</sup>

- <sup>1</sup> Otis Co. v. Missouri Pac. Ry. Co., 20 S. W. Rep., 676.
- <sup>2</sup> Winsor Coal Co. v. Chicago & A. R. Co., 52 Fed. Rep., 716.
- <sup>3</sup> M. Pac. Ry. Co. v. Eckel, 31 Pac. Rep., 693.
- <sup>4</sup> T. St. L. & E. C. v. Jackson, 32 N. E. Rep., 793.
- <sup>5</sup> O. & R. V. v. Clarke, 53 N. W. Rep., 970.
- <sup>6</sup> Talcott v. Wabash R. Co. (Sup.), 21 N. Y. S., 318.
- <sup>7</sup> Fordyce v. Withers, 20 S. W. Rep., 766.
- <sup>8</sup> Fordyce v. Beecher, 21 S. W. Rep., 179.
- <sup>9</sup> Evansville & R. Co. v. Kyte, 32 N. E. Rep., 1,134.
- <sup>10</sup> L. I. & I. Ry. Co. v. Snyder, 32 N. E. Rep., 1,129.
- <sup>11</sup> K. C. M. & B. v. Burton, 12 South. Rep., 88.
- <sup>12</sup> K. C. M. & B. v. Burton, 12 South. Rep., 88.
- <sup>13</sup> O'Malley v. M. Pac. Ry. Co., 20 S. W. Rep., 1,079.
- <sup>14</sup> E. T. V. & G. Ry. Co. v. Turville, 12 South. Rep., 63.
- <sup>15</sup> Refan v. L. S. & M. S. Ry. Co., 53 N. W. Rep., 1,094.
- <sup>16</sup> C. M. & St. P. v. McArthur, 53 Fed. Rep., 461.
- <sup>17</sup> A. T. & S. F. R. Co. v. Priest, 31 Pac. Rep., 674.
- <sup>18</sup> Wellenboffer v. N. Y. L. E. & W. R. Co., 21 N. Y. S., 866.
- <sup>19</sup> T. & P. v. Bledsoe, 20 S. W. Rep., 1,135.
- <sup>20</sup> Refan v. Lake Shore & M. S. Ry. Co., 53 N. W. Rep., 1,094.
- <sup>21</sup> Mitchell v. N. Y. L. E. & W. R. Co., 13 S. Ct., 259.

## MEETINGS AND ANNOUNCEMENTS.

### Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

*Catawissa*, semi-annual, 3½ per cent. on the preferred and common stock, payable June 15.  
*Toledo & Ohio Central*, quarterly, 1 per cent. on the common stock, payable June 10.

### Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

*Canada Southern*, annual, St. Thomas, Ont., June 7.  
*Chesapeake & Ohio Southwestern*, special, Memphis, Tenn., June 13, to approve of the purchase of the Hodgenville & Elizabethtown.  
*Chicago & Eastern Illinois*, annual, Chicago, June 7.  
*Chicago & Northwestern*, annual, Chicago, Ill., June 1.  
*Chicago, St. Paul, Minneapolis & Omaha*, annual, Hudson, Wis., June 3.  
*Compton Heights, Union Depot & Merchants' Terminal*, annual, St. Louis, Mo., May 31.  
*Dakota Central*, annual, Chicago, June 1.  
*Des Moines & Fort Dodge*, annual, Des Moines, Ia., June 1.  
*Duluth, South Shore & Atlantic*, annual, Marquette, Mich., June 1.  
*Keokuk & Des Moines*, annual, Des Moines, Ia., June 7.  
*Leamington & St. Clair*, annual, St. Thomas, Ont., June 7.  
*Mexican Northern*, annual, New York City, June 6.  
*Michigan Midland & Canada*, annual, Detroit, Mich., June 8.  
*Milwaukee, Lake Shore & Western*, annual, Milwaukee, Wis., June 2.  
*Minneapolis, St. Paul & Sauk Ste. Marie*, annual, Minneapolis, Minn., June 6.  
*Mobile & Girard*, special, Girard, Ala., June 7.  
*Mobile & Ohio*, special, Mobile, Ala., May 29.  
*Oregon Railway & Navigation Co.*, annual, Portland, Or., June 19.  
*Parry Sound Colonization*, annual, Parry Sound, Ont., June 7.  
*Peoria, Decatur & Evansville*, special, Peoria, Ill., June 30.  
*Pontiac Pacific Junction*, special, 162 St. James street, Montreal, Que., June 17.  
*St. Joseph & Grand Island*, annual, Elwood, Kan., June 13.  
*St. Louis, Alton & Terre Haute*, annual, St. Louis, Mo., June 5.  
*Sarnia, Chatham & Erie*, annual, St. Thomas, Ont., June 7.  
*Toledo, Canada Southern & Detroit*, annual, Detroit, Mich., June 8.

### Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *International Association of Car Accountants* will hold its next annual convention at Indianapolis, June 19.  
The *Master Car Builders' Association* will hold its annual convention at the Kent House, Lakewood, N. Y., commencing June 13. Applications for rooms should be made to J. B. Brady, Kent House, Lakewood, N. Y.  
The *Master Mechanics' Association* will hold its annual convention at the Kent House, Lakewood, N. Y., commencing June 19.  
The *Association of American Railway Accounting Officers* will hold its fifth annual meeting at the Auditorium Hotel, Chicago, commencing May 31.  
The *Train Dispatchers' Association of America* will hold its annual convention in Salt Lake City, Utah, June 20.  
The *World's Railway Commerce Congress* in connection with the World's Fair at Chicago will hold a meeting at Chicago, June 19.  
The *Association of Railway Telegraph Superintendents* will hold a meeting at Milwaukee, Wis., June 20.  
The *Western Railway Club* meets in room 730, The Rookery Building, Chicago, on the third Tuesday in each month, at 2 p. m. The May meeting has been postponed to May 30.  
The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 7.30 p. m.  
The *Northwest Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month except during June, July and August, at 8 p. m.  
The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.  
The *Boston Society of Civil Engineers* meets at Wesleyan Hall, Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m.  
The *Western Society of Engineers* meets at 78 La Salle street, Chicago, on the first Wednesday in each month, at 8 p. m.  
The *Engineers' Club of St. Louis* meets in the Odd Fellows' Building, corner Ninth and Olive streets, St. Louis, on the first and third Wednesdays in each month.  
The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.  
The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7.30 p. m.  
The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.  
The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 8 p. m.  
The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.  
The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.  
The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.  
The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.  
The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.  
The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday except during the months of June, July, August and September.  
The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.  
The *Tacoma Society of Civil Engineers and Architects*

meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.  
The Association of Engineers of Virginia holds informal meetings the third Wednesday of each month, from September to May inclusive, at 719 Terry Building, Roanoke, at 8 p. m.

#### American Society of Civil Engineers.

At the meeting of the American Society of Civil Engineers on Wednesday evening, May 17, two papers were presented. The first was upon the Detroit Union Depot Viaduct, by J. W. Schaub, Member of the Society.

Mr. Schaub states that in the year 1890 a company was incorporated under the laws of the state of Michigan, known as the Fourth Street Union Depot Company, of Detroit, Mich., composed of four railroad companies, namely the Wabash, the Canadian Pacific, the Pere Marquette, and the Detroit, Lansing & Northern, all entering the city of Detroit over various lines with widely separated termini. To facilitate the interchange of business and for other reasons the company determined to build a Union depot\* with elevated approaches, similar to the Broad street station in Philadelphia. To do this a three-track viaduct 4,000 ft. long was projected through River street. Mr. C. H. Ellis was appointed Chief Engineer and prepared specifications and invited tenders. The contract was let to the Detroit Bridge & Iron Works in January, 1891, and the work was completed in eight months.

The longitudinal force due to the friction between the rails and the wheels of two trains, each weighing 3,000 lbs. per linear foot, moving in the same direction upon the outside tracks, was provided for. The coefficient of friction for this purpose was assumed at 20 per cent., and to resist the force longitudinal bracing was provided for between the columns. This bracing went, in some cases, to the ground, but not usually, and when it did not the strain was taken up by means of flexure in the columns. A wind force of 750 lbs. per linear foot was assumed and provided for. This was taken as acting in a horizontal plane passing through the base of the rails, and to resist it transverse bracing was inserted between the columns. This also in some cases was carried to the ground, but generally it was not. The horizontal displacement of both dead and live loads due to wind was provided for in proportioning the columns. In proportioning the columns the combined stresses resulting from direct loading, displacement by the wind and cross-bending were provided for. In no case were the stresses resulting from wind and friction assumed to occur at the same time.

The material in the superstructure is steel, excepting the bracing anchorages which are iron. The bearing plates are cast iron. The steel used is medium steel, excepting the rivets, which are soft steel. No shape iron or steel weighing less than 6 lbs. per linear foot was used; no web plates less than  $\frac{3}{8}$  in. thick, and no metal less than  $\frac{3}{8}$  in. thick. All holes were punched and reamed, and all sheared edges of web plates were planed. In steel the working stresses per square inch were for tension flanges 10,000 lbs. (net) and compression flanges were given the same gross area as the tension flanges.

In no case did the combined stresses in the columns from wind or friction exceed 12,000 lbs. fibre strain per square inch on the outer fibres. Shearing on rivets, 9,000 lbs.; bearing on rivets, 14,000 lbs., and field rivets only two-thirds of this. Bolts were mostly used for these field rivets. These were cut from cold rolled steel shafting  $\frac{1}{2}$  in. in diameter, so as to tightly fit the holes, and were threaded and provided with a nut and washer at each end, and their value was taken as that of field rivets.

The salient features in the design were:

First—The absence of all adjustable members, all bracing being riveted.

Second—The form of expansion joints used for longitudinal girders.

Third—The connections for anchor rods to columns.

Fourth—The use of cast bearing plates for distributing the pressure on the masonry.

Fifth—The form of the longitudinal bracing.

Where no clearance was required under the structure, the bracing ran to the foot of the column. Over streets 14 ft. clearance was required. Expansion joints were provided every 19 ft. longitudinally.

A deck traveler was used which handled a cross-girder weighing 50,000 lbs. at the end of booms reaching out 80 ft. It was counterbalanced with 75 tons of pig iron.

No special difficulties were encountered with the structure. A thin layer of cement was used to bring the cast bearing plates to a level, but the writer does not recommend thin layers of cement. They do not make a good bond with the coping stone, and soon crumble and wear away at the edges of the casting. Plaster of Paris for such areas seems to promise well, for even in thin layers it makes a bond with the coping stone and sets rapidly. To retard its setting, a little lime can be added. The use of sheet lead is questionable. Ordinarily the working pressures on the bearing plates are not sufficient to cause the lead to flow. Even where coping stones are dressed to a true level and the columns placed in position, it is not unusual to find that they are not plumb, and some simple method must be found to remedy the evil and not delay the work. The question is an important one, especially where the direct bending in the columns is such a large factor.

#### The Civil Engineers' Club of Cleveland.

At the meeting May 9, 30 members and visitors were present. A verbal report was received from the Local Committee on Columbian Exposition by Messrs. C. M. Barber, chairman, and W. H. Searles, secretary. The committee was enlarged by the following: Messrs. W. J. Blunt, Jas. Ritchie, E. F. Roberts, H. C. Thompson, F. H. Neff, Ludwig Herman, A. A. Honsberg and F. A. Coburn. Mr. W. L. Cowles was appointed by the president as alternate member General Committee of Engineering Societies, Columbian Exposition.

Mr. Porter presented a report from the Committee on New Quarters to the effect that the needs of the club were being considered in connection with the prospective new building for Case Library.

Mr. Cully introduced the following resolution:

"Resolved that we, the Civil Engineers' Club of Cleveland, O., adopt the Ohio legal standard time, and that hereafter the secretary shall designate 'Standard Time' in the call for meetings of the club." On motion of Mr. Searles it was referred to the Executive Board for action.

Mr. C. W. Hopkinson then read a paper on "The Proper Critical Attitude Engineers and Architects Should Assume in Attending the World's Fair." The paper was discussed by Messrs. Benjamin, Searles, Herman, Hopkinson, Coburn, Osborn and Palmer.

\* See Railroad Gazette, Jan. 27, 1893, for illustration of this depot.

#### Engineers' Club of Philadelphia.

At the meeting of May 6 a committee, consisting of Messrs. Webster, Close and Trautwine, presented a memorial on Mr. N. W. Thayer, who was born in 1862 and died March 14, 1893. After completing his studies he was employed on the Philadelphia & Reading Railroad for three years, then was employed as Assistant Inspector of Bridges and Track Material on the Pennsylvania, and in 1886 became Assistant Engineer on the Baltimore & Ohio. There he was in charge of completing the Twenty-fifth street tunnel in Philadelphia, an account of which has been published in the *Transactions* of the American Society of Civil Engineers. After the completion of that tunnel he accepted the position of Assistant Engineer at Fairmont Park, and at the time of his death was Surveyor and Regulator of the Fourth Survey District of Philadelphia. He was an active member of the Engineers' Club of Philadelphia, and an associate member of the American Society of Civil Engineers, and was considered a man of great promise in his profession.

President Birkinbine presented a brief paper on Engineering in Mexico. He gave a table of the different elevations of the 6,831 miles of railroad in the republic, showing that three-quarters of the entire mileage is at elevations greater than those reached by any railroad in Pennsylvania, and about half of it is over 5,000 ft. above tide water. There are some 200 miles of track at altitudes of from 8,000 to 10,000 ft.

A paper by Mr. Pierre Giron on the Preparation of Portland Cement was read by the Secretary. This was discussed by several members.

#### Engineers' Club of St. Louis.

The Club met at 8 p. m. on April 19, President Moore in the chair, 22 members and two visitors present.

Capt. Carl F. Palfrey then gave the paper of the evening on "Three Reconnaissance Maps in the Latter Part of the Last Century, as Compared with the Maps of the Mississippi River Commission." The paper was an interesting discussion of the changes in the river for the last century. The old maps, while containing some errors, were, on the whole, remarkably accurate. Discussion followed by Messrs. Ferguson, Sedden, Blaisdell, Baier, Johnson, Moore and Ockerson.

At the meeting on May 3, 31 members and two visitors were present.

Mr. N. W. Eayrs presented the paper of the evening on "Corroded Girders in the Bridge Approach, Illustrating a Peculiar Condition of the Strains in the Webs of Plate Girders." The web in a number of the girders had been corroded and eaten away, leaving a number of large holes in the web. The girders were erected nearly twenty years ago. The destruction of the web was caused by the smoke and heat of the engines. In painting the girders a charcoal and litharge paint was found to be the best, owing to its remaining soft in spite of the heat. Discussion followed by Messrs. Wheeler, Hermann, Moore, Kinealy, Sedden, Johnson, Ockerson, Condron, Baier, Ferguson, Brauer, Colby.

Professor Johnson described a new apparatus for testing the girders in bridges.

#### New England Water-Works Association.

The twelfth annual convention will be held at Worcester, Mass., June 14, 15 and 16, 1893. The headquarters of the association during the convention will be at the Bay State House. A large space on the first floor of the Bay State House will be devoted to the exhibit of water-works appliances.

The programme includes a report on "Uniformity in the Preparation of the Annual Report," by Desmond Fitzgerald, Chairman of a special committee, and papers by John Thomson, W. E. McClintock, Prof. Dwight Porter, F. F. Forbes, William R. Hill, Dexter Brackett, F. W. Dean and others.

#### The Technical Conventions.

The Kent House and the Sterlingworth Inn, at Lakewood, N. Y., will be open during the Master Car Builders' and Master Mechanics' conventions in June. Applications for rooms should be made to J. B. Brady, Kent House, Lakewood, N. Y. The following are the routes to Lakewood: Lake Shore & Michigan Southern or New York, Chicago & St. Louis to Brockton; Western New York & Pennsylvania to Mayville, thence by boat to Lakewood. Or passengers may go by Western New York & Pennsylvania to Greenhurst Ferry and thence across to Lakewood. On the Erie all through trains stop at Lakewood. Passengers should avoid going to Jamestown instead of Lakewood.

#### PERSONAL.

—Mr. Horace See, of New York, delivered a lecture on the Development of the Steamship before the students of the Rensselaer Polytechnic Institute, at Troy, May 18.

—Mr. A. A. McLeod tendered his resignation this week as President and Director of the Boston & Maine. Mr. Frank Jones, now Vice-President of the company, who was President before the election of Mr. McLeod last fall, will probably be again chosen President.

—Mr. Henry G. Thompson, who has recently resigned as General Passenger Agent of the Gulf, Colorado & Santa Fe, has been transferred to the Southern California Railroad, also part of the Atchison system, as General Passenger Agent with headquarters at Los Angeles.

—Mr. Isaac L. Rice has sent to President Harris, of the Philadelphia & Reading Railroad, his resignation as foreign representative of the company. He has also resigned as agent of the Pennsylvania Company for Insurance on Lives and Granting Annuities to investigate Reading affairs.

—Mr. James Frederick Walker, Traffic Auditor of the Grand Trunk, died at Toronto, Ont., on May 31, after a short illness. He was 51 years old, and had been in the railroad service in Canada since 1858, all of that time except four years on the Grand Trunk road. He was Assistant Auditor of that company for a long time, being then promoted to be Traffic Auditor.

—Mr. Carlton W. Paris, Central Passenger Agent of the Ohio & Mississippi, with office at Cincinnati, has resigned, and the position will be abolished under the consolidation with the Baltimore & Ohio Southwestern. Mr. Paris has been connected with the passenger department of the company for 23 years, first as Ticket Agent at Cincinnati and later as General Agent.

—Mr. George Gould has notified the directors of the Pacific Mail Steamship Company that, owing to the many calls upon his time, he will not be a candidate for reelection to the office of President at the next annual

meeting, which will be held on May 31. It is expected that Mr. C. P. Huntington will accept the position, as he has been urged to do so by some of the largest stock holders.

—Mr. J. V. McNeal, Auditor of the Indianapolis, Decatur & Western, has been appointed Assistant Treasurer of the Baltimore & Ohio with office in Baltimore. Mr. McNeal was formerly connected with the company, serving as Chief Clerk to the Auditor from 1873 to 1880. He then became Auditor of the Indianapolis, Decatur & Western, and lately has been General Agent to the trustees operating the property, in addition to his other duties.

—Mr. Horace F. Smith, Division Freight Agent of the Louisville Southern, has been appointed General Freight Agent of the Queen & Crescent, vice David Miller, Traffic Manager, who resigned to become Traffic Manager of the Missouri, Kansas & Texas. Mr. Smith is a brother of M. H. Smith, President of the Louisville & Nashville, and before being associated with the Louisville & Nashville and East Tennessee was with the Atchison, Topeka & Santa Fé, at Kansas City.

—Mr. Thomas Fitzgerald, who has just been appointed Superintendent of Transportation of the Baltimore & Ohio, is at present Superintendent of the Baltimore Division. Mr. Fitzgerald entered the service of the company as a boy in 1865. He has filled the position of dispatcher at Camden Station, chief train dispatcher, supervisor of trains Valley Division, train master of the Ohio Division, master of transportation of the Ohio Division, superintendent of the First Division, and his present position of superintendent of the Baltimore Division, the duties of which latter position he will continue to discharge in addition to those of his new appointment.

—Mr. Henry Villard, Chairman of the Board of Directors of the Northern Pacific, issued a statement last week concerning the newspaper reports of his resignation from the company. He says that on March 1 last, after the reply of the Northern Pacific Directors to the report of the stockholders' committee, and in accordance with a long-entertained intention, he addressed a formal letter of resignation to President Oakes. Mr. Oakes requested him to withdraw his resignation, as the company needed his services in funding the floating debt. This he consented to do with the qualification that he be asked to serve no longer than next October, when his present three years' term as a director expires.

—Sir James Anderson, who recently died in England, was associated with 12 cable companies, with an aggregate capital of over £21,000,000, and controlling over 80,000 miles of submarine cable. He commanded the Great Eastern in 1865, in its expedition to pick up the Atlantic cable, which was done successfully, although the break was in water more than two miles deep. For this exploit he was knighted. He wrote considerably on telegraphs and cables and had been decorated with several foreign orders and otherwise distinguished. He was born in 1821, and before he took the command of the Great Eastern he had successfully commanded 14 steamships belonging to the Cunard line, which service he entered in 1851.

#### ELECTIONS AND APPOINTMENTS.

**Atlantic & Lake Superior.**—A preliminary organization was effected at Montreal last week, and the following directors and officers: President, Hon. J. R. Thibault, Montreal; Vice-Presidents, Col. A. R. Chisholm, New York, and D. Berzin, Cornwall, Ont.; Secretary and Manager, C. N. Armstrong, Montreal; Directors: A. F. Gould and J. N. Greenfields; Q. C. Montreal; D. Davis, Ottawa; R. R. McLennan, M. P., Glengarry.

**Baltimore & Ohio.**—The office of Superintendent of Transportation of the B. & O. R. R. system has been created. This officer, under the direction of the General Manager, will have general charge of the distribution of all classes of equipment, including motive power over the entire system. General and Division Superintendents will report to him in relation to the distribution thereof. Thomas Fitzgerald has been appointed Superintendent of Transportation, with office at Camden Station, Baltimore. The duties of Superintendent of the Baltimore Division will continue to be discharged by Mr. Fitzgerald until otherwise announced. The car accounting will continue in charge of the Superintendent of Car Service.

**Central Ontario.**—The general meeting of stockholders was held at Toronto, Ont., last week and the following directors were elected: Ex-Senator Payne, Judge Stevenson Burke and H. P. McIntosh, of Cleveland, O.; George M. Allen, of Akron, O.; Alexander McLaren, of Ottawa, and Thomas G. Blackstock, of Toronto.

**Central of Pennsylvania.**—The names of the officers of the company are as follows: Walter L. Ross, President; Wm. J. McHugh, Secretary and Treasurer, and J. W. Gephart, Superintendent of Construction, and H. E. Richter, Chief Engineer, of Bellefonte, Pa. The principal office of the company is at 304 Walnut street, Philadelphia, and the construction headquarters are at Bellefonte, Pa.

**Clarion River.**—O. F. Bedell, Assistant City Engineer of Altoona, Pa., has been appointed Chief Engineer of this road with office at St. Mary's, Elk County, Pa.

**Delaware Valley.**—At a meeting at Stroudsburg, Pa., of those interested in the building of the road, an organization was effected and the following officers were elected: President, Stephen Holmes; Treasurer, F. H. Smith; Secretary, Van C. Peters; directors, P. F. Fulmer, E. F. Smith, J. Ottenheimer, M. J. Coolbaugh, E. A. Bell, William Wallace, George Estaffier, L. Turn, C. Van Allen, S. G. Peters, J. M. Kerr.

**Flint & Pere Marquette.**—At the annual meeting of the stockholders at Saginaw, Mich., May 17, directors were elected as follows: W. W. Crapo and L. Snow, New Bedford, Mass.; J. W. Mackintosh, Frank Morison, J. L. Stackpole, Boston, Lewis Peirce, Portland, Me.; George Coppel, New York; P. C. Potter, Saginaw; H. B. Stone, Chicago; H. C. Potter, Jr., Saginaw; W. H. Tousey, Bay City, Mich.

**Gulf, Colorado & Santa Fe.**—Joseph Billingham, Master Mechanic, having resigned, George A. Hancock has been appointed Superintendent of Machinery of this company, with headquarters at Galveston.

**Long Island.**—George H. Clarke has been appointed Superintendent of the Long Island Express, to succeed Frank M. Kelley, resigned.

**Missouri, Kansas & Eastern.**—At the annual meeting of the stockholders, at St. Louis, May 22, the old board of directors were re-elected. At the meeting of the directors the following officers were elected: Edward C. Simmons, of St. Louis, President; Z. S. M. Kennard, Vice-President; Louis C. Nelson, Treasurer; George D. Dana, Secretary.

**Missouri, Kansas & Texas.**—The official announcement was issued this week of the appointment of David Miller as Traffic Manager.

**Mobile & Ohio.**—The general mortgage bondholders of the railroad have nominated the following named gentlemen to be voted for as directors of the company: Adrian Iselin, Jr., C. C. Cuyler, H. B. Plant, F. D. Tappan, A. H. Stevens, Thomas E. Jevons, C. Sidney Sheppard, J. H. Far, James M. Masson, E. L. Russell, J. C. Clarke, E. S. Knapp and W. Butler Duncan. Messrs. Jevons, Masson and Knapp are new men.

**New York & New England.**—H. J. Quigg, Train Dispatcher of the New York, Lake Erie & Western, at Newburgh, N. Y., has been appointed Superintendent of the Western Division of this road, with headquarters at East Hartford, Conn., to take effect June 1.

**Northern Adirondack.**—J. H. Hamilton, formerly of Kearney, Neb., has been appointed General Manager, and he will have headquarters at Santa Clara, N. Y.

**Omaha & St. Louis.**—At the annual meeting of the company, held on May 16, James H. Smith, Walter Bound, George Warden Smith, Charles G. Thompson, Henry W. Eaton, W. H. M. Pusey and Edward W. Sheldon were elected directors.

**Peoria, Decatur & Evansville.**—J. H. Hedden, Car Accountant, having resigned, the car records have been moved from Evansville, Ind., to Mattoon, Ill., and all correspondence in reference thereto should be sent to R. B. Starbuck, Superintendent, Mattoon, Ill., who assumes charge of the work.

**Pittsburgh, Youngstown & Ashtabula.**—At the annual meeting at Youngstown, O., May 18, the following Board of Directors was elected: William Mullins, James McCrea, John E. Davidson and Benjamin Thaw, of Pittsburgh; Caleb B. Wick, W. Scott Bonnell and John G. Butler, Jr., of Youngstown; Henry L. Morrison and Thaddeus E. Hoyt, of Ashtabula; George B. Roberts and John N. Hutchinson, of Philadelphia.

**Ravenswood, Spencer & Glenville.**—The stockholders of this company held their annual meeting at Spencer, W. Va., last week and elected the following directors: B. D. Williams, J. L. Armstrong, J. G. Schilling, P. C. Adams, Walter Pendleton, D. W. Chapman and William Woodyard. The directors elected William Woodyard President and D. W. Chapman Secretary.

**Saginaw, Tuscola & Huron.**—Maj. W. C. Ransom, of Kalamazoo, has been appointed Auditor of this road, vice James G. Harris, resigned. Mr. Ransom was formerly Deputy Railroad Commissioner of Michigan.

**St. Paul, Minneapolis & Lake Superior.**—Articles for the incorporation of the company were filed last week. The following are the officers: Donald Grant, Faribault, President; K. D. Chase, Faribault, Vice President; Wm. Dawson, St. Paul, Treasurer; Moses E. Clapp, Attorney, and F. H. Anson, Minneapolis, Secretary and General Manager.

**San Antonio & Aransas Pass.**—G. A. Hancock having resigned to assume other duties, L. H. Waugh has been appointed to act as Superintendent of Motive Power and Machinery until further orders. Henry El-mendorf and E. P. Swenson have resigned as directors, and C. D. Dorman and Jas. W. Terry have been elected to fill the vacancies.

**Sioux City & Northern.**—The Board of Directors of the company last week elected officers. The new officers are: A. S. Garretson, President, and G. W. Oakley, Secretary and Treasurer.

**Williamsport & North Branch.**—At the annual meeting held in Hughesville, Pa., last week these officers were re-elected: President, Hon. Henry C. McCormick; Vice-President, John Satterfield; Secretary, Seth T. McCormick; Treasurer, J. Henry Cochran; Directors, W. L. Taylor, John Satterfield, J. Henry Cochran, E. R. Payne, J. Raymond Claghorn and S. T. McCormick. B. G. Welch was re-elected General Manager.

#### RAILROAD CONSTRUCTION. Incorporations Surveys, Etc.

**Atlantic & Lake Superior.**—The organization of this company was completed at Montreal, Que. C. N. Armstrong, of Montreal, the projector and Manager of the company, says that the project is to complete a new railroad through Canada from the Atlantic to Sault Ste. Marie, by combining with existing roads, and building connecting links, to complete a through route. The Bay des Chaleurs, the Intercolonial, to Lewis, opposite Quebec, the Great Eastern, the Ottawa Valley and Pontiac & Pacific Junction, are some of the roads which, according to the prospectus, will be combined in the scheme. A. R. C. Hisholm, of New York City, is Vice-President of the company.

**Baltimore & Cumberland.**—Three parties of engineers are working on the location between Cumberland and Hagerstown, Md., and are making rapid progress. Already 80 miles of the right of way has been secured by purchase and condemnation suits have been begun for the balance. One party of engineers is at work at the Cumberland Valley Junction to secure an entrance into Hagerstown. At first it was proposed to make the connection with the Cumberland Valley at State Line, but it was found that a connection at Half Way would be more advantageous to both roads, and the entrance to Hagerstown will probably be made at that point. The Cumberland Valley tracks will be used by both roads from Half Way to Hagerstown. Although the road passes through hilly country, it will have but three tunnels on the entire line, aggregating about 2,300 ft. An officer of the road said last week that the whole line will be placed under contract by June 1. There are now 400 men at work near Cumberland on the spur which is to connect the West Virginia Central & Pittsburgh and the new road. A cut through a spur of Knobley Mountain, 400 ft. in length and 30 ft. deep, is now being made. Beyond this there are heavy fills for five miles to where the first tunnel is met, and there are five miles of very heavy work before the Potomac River is crossed. W. E. Porter, Superintendent of Construction on the West Virginia Central & Pittsburgh, has charge of the construction.

**Buffalo, Rochester & Pittsburgh.**—The two branch roads of this company, the Johnsonburgh & Bradford and the Clearfield & Mahoning, will be opened for regular passenger traffic on May 28. The former road extends from Mt. Jewett, south to Howard Junction, Pa., 20 miles, the track of the New York, Lake Erie & Western between these points having been previously used. The Clearfield & Mahoning is 28 miles long, and extends from a point near DuBois east to Clearfield, connecting at that point with the Beech Creek road.

**Cape May.**—Logan Bullitt, of Philadelphia, has arranged with the officers of the Pennsylvania, on behalf of the projectors of this road, for the purchase from the Pennsylvania of the old Philadelphia & Cape May Railroad, between Winslow Junction and Tuckahoe, N. J., which is now operated by the West Jersey. The terms of the sale have not been published; but if the road is transferred, as now arranged, the project for building across the State of New Jersey to Cape May will be abandoned, and, instead, the road purchased from the Pennsylvania will be improved and branches built to Sea Isle City and to Cape May. The grading was partly completed for the line from Tuckahoe to Cape May, and valuable terminal property secured in the latter town when the road was under construction to Cape May.

**Central of Pennsylvania.**—The construction work on this line was begun May 3, as already reported, near Bellefonte, Pa., and about 150 men are now at work. The route of the line is from Bellefonte northeast to Mill Hall, Pa., via Zion, Hecla Furnace, Rublersburg, Nittany, Washington Furnace (Lamar Post Office), Mackeyville and Cedar Springs. All the surveys are made and construction has actually begun. No contracts for grading or tracklaying will be let, but the work will be done directly under the supervision of the company, and J. W. Gephart has been appointed Superintendent of Construction. No track has been laid yet, but it is expected to complete the entire road before December. The work is nearly all light, through a finely cultivated agricultural district. Most of the grades do not exceed one per cent, and the only exceptions are at one or two short stretches of from  $\frac{1}{2}$  to  $\frac{3}{4}$  mile, where it will reach as high as 90 ft. in the mile. Maximum curves will not exceed 10 degs. There will be 9 or 10 iron girder bridges, either deck or suspension. The length will vary from 80 to 120 ft. The funds have been absolutely provided for the building of the line. H. E. Richter of Bellefonte, Pa., is Chief Engineer.

**Chicago, St. Paul, Minneapolis & Omaha.**—Stebens Bros., of Sioux City, have a contract for grading six miles of the extension of the branch from Ponca to Newcastle, Neb., and have commenced work at Ponca.

**Denver & Rio Grande.**—A party of engineers is making a survey of a route up Dry Creek to Silver Cliff, Col., for a local company. It is stated that a road will be constructed by the local company, and that it will be operated as a branch of this line.

**Duluth, Missabe & Northern.**—The proposed Superior branch of this road is to extend almost due west from Ore Junction, Minn., to Superior Mine, a distance of 17 miles. The surveys have been completed and the contracts let, the grading to Wolf & King and the bridging to M. J. Peppard; the addresses of both are Duluth, Minn. The work has just begun. It is not heavy, the maximum grades being 33 ft. a mile going west and 26.4 ft. going east; the maximum curvature is three degrees. The bridging is light, there being about 1,000,000 ft. of trestle bridging.

**Galveston & Western.**—A meeting of the stockholders has been called for July 12 to authorize the directors to issue bonds for \$340,000, or at the rate of \$20,000 a mile, on the 17 miles of road now operated on Galveston Island. Various extensions of the line are proposed by the directors to connect with the North Galveston, Houston & Kansas City, to Bolivar Point, etc., but the plans for these extensions have not been definitely considered by the directors.

**Gulf, Beaumont & Kansas City.**—Bids for clearing the right of way and for the grading and track-laying on the road north of Beaumont, Tex., were received by Gen. H. K. Kirby, Vice-President of the company, on May 20, and he expects to let the contract before June 1 for the 25 miles to the crossing of the Neches River. A locomotive for the line has already been delivered, and 20 cars have been ordered.

**Gulf & Tennessee.**—Bids for the construction and equipment of the road from Jackson, Tenn., south are being received. This company, it will be remembered, was chartered last December to complete the line known as the Gulf & Ship Island, from Gulfport, Miss., to Jackson, Tenn. Certain securities held by Ham & Clark, creditors of the Gulf & Ship Island, will be sold on May 29, by order of the court, and it is expected that this company will buy them, so as to control the old charter, which grants valuable privileges, such as freedom from taxation for a term of years, grants of land, etc. The new company consists mainly of Englishmen. The President is Dr. G. Frederic B. Howard, Jackson, Tenn.

**Hamilton, Grimsby & Beamsville.**—President Myles has asked that a meeting of the Finance Committee of Hamilton, Ont., be called to reconsider the granting of a bonus to the company. The committee recommended that a bonus of \$20,000 be granted. The directors ask that \$25,000 be granted, \$20,000 on completion of the road to Grimsby, and the remaining \$5,000 when it is running to Beamsville, Ont.

**Hodenville & Elizabethtown.**—General Echols, Vice-President of the Newport News & Mississippi Valley Co., which operates this road, reports that the preliminary survey for the extension of the road to connect with the Chesapeake & Nashville has just been completed. The new line, according to the survey, will be about 70 miles long. It begins at Hodenville, Ky., and extends south to Scottsville, Ky., the northern terminus of the Chesapeake & Nashville. The latter road extends to Gallatin, Tenn., within 20 miles of Nashville, and speculations have been started as to whether the company will not extend the latter road into Nashville.

**Intercolonial.**—Tenders addressed to the General Manager at Moncton, N. B., will be received until May 31, for the construction of an extension along the water front at St. John, N. B., from the Intercolonial Deep Water Terminus to Corporation Pier.

**Kanawha & Michigan.**—Rain and high water have retarded the work on the bridge at Narrows Falls, W. Va., but it is now nearing completion, the superstructure being well along. On the road all the work is done except the laying of the rails and this has progressed as far as Cannelton, and with fair weather will likely be completed by June 1. The track-layers on the Gauley

extension of the Chesapeake & Ohio are well along with the work and will soon be ready to make a connection with the Kanawha & Michigan.

**Kaslo & Slocan.**—Bids for the clearing and grading on the first five miles of the road from Kaslo, B. C., to the south fork of the Kaslo River will be received up to June 1 at Victoria, B. C., by A. J. W. Bridgman. Bids for other sections of the road to the Slocan mining district will be called for soon. The construction work on the line will begin fully two months sooner than the time previously announced. President Hendry says that he hopes to have 1,000 men at work during the summer, and to complete the greater part of the work early in October, and to have part of the line ready for traffic at that time. Chief Engineer McMullen is now completing the location on the western end of the line, which will be about 30 miles long.

**Keeseville, Ausable Chasm & Lake Champlain.**—The surveys have been completed for an extension of this line from Keeseville to Saranac Lake, N. Y., where a connection will be made with the Adirondack & St. Lawrence branch. The line will extend in a southwesterly direction up the Ausable River until it reaches Upper Jay and thence westerly to Lake Placid and to Saranac Lake. The grade by this route will not exceed 104 ft. to the mile. Nearly 20,000 acres of timber land's will be opened by the extension, which will also reach valuable iron ore mines.

**Minneapolis, St. Paul & Sault Ste. Marie.**—The work of completing the extension to the international boundary is being pushed by Linton & Co., the contractors. They are now at work near Carthay, N. Dak., with some 600 teams. The cold, wet weather delayed the work, but from now on it is their intention to make up for lost time.

**Monterey & Fresno.**—The contract for the first ten miles of the railroad has been signed, the construction work to begin at once at the Monterey end.

**Nelson & Fort Sheppard.**—Larson & Co., who have the contract for building the road, have one right of way and two grading camps established on the south end of the line, in British Columbia. The piers for the Pend d'Oreille bridge are nearing completion. On the foundations are built iron cylinders filled with concrete.

**Nevada Southern.**—The road has been completed as far as Purdy Station in the Marvel mining district in Nevada, 25 miles from Blake station on the Atlantic & Pacific. The extension will be completed to the Vanderbilt district in about two weeks, a distance of five miles. Artesian experts have discovered four zones of water in the Dry Lake valley. A party of San Francisco capitalists will ride over the proposed route into Southern Utah early in June.

**Norfolk & Western.**—The new ten-mile extension from Dingess, W. Va., to the Logan county coal fields is progressing rapidly and will be ready to open in a few weeks. There are already six large coal concerns ready to begin shipments as soon as the line reaches them.

**Northern Pacific.**—It has been decided to build a branch of the Grays Harbor line to Aberdeen, Wash., on the north side of the Chehalis River, and also to Hoquiam. It is said that the company will commence its extension a mile and a half east of Aberdeen, where the line to South Aberdeen now crosses the river to the south side. A spur a mile and a half long, built westward from this point, will reach Aberdeen, and it is expected that the extension will be continued on three miles further, to the town of Hoquiam. When the line was built to Grays Harbor three years ago there was some trouble about securing a right of way into Aberdeen, and this, it is supposed, is the reason why the railroad never built to that town.

It is expected that the branch line from Chehalis to South Bend, Wash., will be turned over to the operating department in the near future. The officials are now making an inspection trip over the road, and find it in condition to be operated.

**Pennsylvania.**—In several weeks work is expected to be completed in the large rock cut at Conewago, Pa., and then the company will have a direct line from Conewago to Middletown. McManus & Reilly, the contractors, have been at work at this point for over a year, much of the time night and day. Assistant Engineer W. B. Pritchard has direct supervision. The cut is 100 ft. deep and about 1,500 ft. long.

Work was resumed again last week on the Peter's Creek branch, and the road will soon be completed.

**St. Louis & Eastern.**—The formal opening of this road will occur probably this week. The road is about 11 miles long from near East St. Louis to Marine, Ill. Traffic is going over the road now, but regular trains have not yet been put on. The road will give access to an important part of Illinois and will open up some rich coal mines. There are several thriving towns along the line, Glen Carbon, one of them, which was founded two years ago, having already 1,000 people.

**St. Paul, Minneapolis & Lake Superior.**—Articles of incorporation for this company were filed at West Superior, Wis., last week. Donald Grant, of Faribault, Minn., is President, and K. D. Chase is Vice-President. It is proposed to build the line from St. Paul to the head of Lake Superior, and the projectors state that the new route will be 136 miles long to Duluth, shorter than the St. Paul & Duluth or any of the present roads between those points. The projectors say that they have arranged to begin the actual work of construction next month.

**Sioux Falls, Yankton & Southwestern.**—The right of way troubles which last week threatened to cause considerable delay in the construction of the road have been settled and the grading has been resumed. The road is being built from Sioux Falls to Yankton, S. D., 60 miles, and it is expected will be completed by Aug. 1.

**South Mountain.**—Considerable effort is being put forth again looking to the organization of a company with sufficient capital to build this abandoned line. This week a party of Philadelphia capitalists passed over the route, examining the work already done and ascertaining what work is yet necessary in Dauphin, Berks and Lebanon counties.

**Texas City Terminal.**—This road is being built by Meyer Brothers, of Duluth, Minn., from a point on the Galveston, Houston & Henderson north of Virginia Point and 11 miles from Houston west to a point on Galveston Bay. The firm building the line owns several miles of water front property on Galveston Bay, and proposes to build a system of wharves out to deep water. The railroad will be seven miles long, and will soon be completed, the track laying being now in pro-

gress. The road is through a practically level prairie country.

**Victoria & Sydney.**—The contract for this road has been awarded to T. W. Patterson, of Victoria, B. C., who started a gang of graders to work at Sydney last week. It is expected that the line will be completed and in operation before the fall, between the two towns.

**Wheeling & Lake Erie.**—Engineers are at work on an extension from the main line in Jefferson county, Ohio, to the Smithfield coal fields, a distance of nine miles. It is understood that a syndicate of capitalists of Pittsburgh, Pa., who hold options on the coal in the Smithfield region will advance the funds for the branch, though the railroad is doing the work.

#### GENERAL RAILROAD NEWS.

**Augusta Southern.**—This road, a re-organization of the Augusta, Gibson & Sandersville road, has been leased to Allen W. Jones, of Midville, Ga., for a term of 30 years at an annual rental of \$20,000, which will amount to about six per cent on the bonds. It is believed that the road is to be changed from a narrow to standard gauge, and possibly extended to Thomasville, Ga., or some other point to give new connections.

**Baltimore & Lehigh.**—Receivers were appointed last week for the Baltimore Forwarding & Railroad Co., which is now operating this railroad and is changing its gauge to standard. William H. Bosley was appointed Receiver for the property in Maryland, on the petition of the minority stockholders, on the ground that the company was insolvent and was unable to pay the contractors for the work they had done. This application was supported by a petition from William Kenefick, the contractor. Winfield J. Taylor was appointed Receiver for the line in Pennsylvania, on the petition of the officers of the company. The latter Receiver seems to be in possession of the road, but has been ordered to transfer the property in Maryland to the first-named Receiver.

**Bellaire, Zanesville & Cincinnati.**—Col. S. L. Mooney, President of the railroad, last week made a cash payment of \$20,000 to the County Commissioners of Muskingum county, Ohio, for the nine miles of the road which the county owns, and which was sold by the Commissioners several weeks ago. It is understood that the suits which were threatened by citizens to annul the sale have been withdrawn.

**Bucouche & Moncton.**—This railroad is again advertised to be sold, this time pursuant to the directions of a decretal order of the Supreme Court in equity, at the suit of the Central Trust Company of New York. The sale is to take place in Moncton, N. B., Aug. 3. The road extends from Bucouche to Moncton, 32 miles.

**Concord & Montreal.**—In relation to the much discussed question concerning the negotiation for a lease of this road to the Boston & Maine, ex-Gov. Frederick Smyth, of Manchester, President of the former corporation, said this week: "I am personally opposed to the leasing of our road to the Boston & Maine, and I do not understand how we could gain anything by such action. We are able to pay our stockholders as high dividends as in any probability they would receive under a lease to the Boston & Maine. I am a member of the special committee of our corporation which recently met a similar committee from the Boston & Maine to discuss the subject of a closer union between the two systems. No definite propositions were presented or even talked over, and, although the conference adjourned without date, it is understood that another meeting will be held. The Boston & Maine would secure valuable advantages if it could obtain control of the Concord & Montreal, but the two systems are now getting along very amicably."

**Marietta & North Georgia.**—Judge Newman, at Atlanta, Ga., has passed a final decree in the United States Court for the sale of this railroad within 60 days. The minimum price fixed by the order is \$925,000 for the Georgia portion of the line and \$900,000 for the Tennessee portion—\$1,725,000 for the whole. The road is to be sold under the petition of the Central Trust Co. of New York. R. J. Lowry, of Atlanta, and Receiver Glover, of Marietta, are named as commissioners to dispose of the property.

**Mount Holly, Lumberton & Medford.**—The proposition of the Pennsylvania Railroad Co. to abandon this branch is being strongly opposed by the stockholders of the latter road, who say they will insist upon the lease to the Pennsylvania, by which it agrees to operate the road for 999 years. The branch is six miles long, from Mount Holly to Medford, N. J.

**Northern Pacific.**—The directors last week adopted the plan submitted by the Finance Committee, for financing the floating debt. The plan authorizes the issue of \$15,000,000 of collateral trust notes, of which \$12,000,000 are to be issued at once. They will be six per cent, notes payable in five years, and will be secured by the deposit of securities now in the treasury of the company and those pledged for the floating debt, with the Farmers' Loan & Trust Company. To secure the new bonds the company has in its treasury about \$6,250,000 of the stock of the St. Paul & Northern Pacific Railroad, about \$12,000,000 of the Northern Pacific consolidated five, and between \$2,000,000 and \$3,000,000 worth of Northern Pacific express stock. A syndicate has been formed to underwrite the issue of bonds for an amount sufficient to fund the floating indebtedness of about \$9,000,000 and also provide adequate working capital. Subscriptions to the underwriting syndicate include that of Mr. John D. Rockefeller for \$3,000,000, and of capitalists associated with him and representing the so-called Wisconsin Central interest for a like amount. Director Charles B. Wright, of Philadelphia, is credited with the subscription of \$1,000,000, and Chairman Henry Villard also with \$1,000,000. The remaining \$4,000,000 has been subscribed by various interests connected with the company. The committee is as follows: R. G. Rolston, President Farmers' Loan & Trust Co.; John A. Stewart, President United States Trust Co.; James Stillman, President National City Bank, and John D. Probst and F. T. Gates.

**Philadelphia & Reading.**—The plans for the re-organization of the company are reported to be all arranged except a few minor details, and it is announced that the publication of the plan will be postponed until these have been settled. It is expected that the plan will be published about June 1. Mr. George M. Pullman has subscribed \$1,000,000 of the new collateral trust bonds which are to be issued. Mr. Pullman holds nearly \$5,000,000 of equipment notes given by the company for cars built by the Pullman Company, these notes falling due monthly and bearing six per cent, in-

terest. It is not apparent whether Mr. Pullman has agreed to any change in the status of this account.

**Pittsburgh, Shenango & Lake Erie.**—Articles consolidating the Erie Terminal and the Conneaut Terminal Railroad companies, with the Pittsburgh, Shenango & Lake Erie under the latter name, have been filed in Pennsylvania. The capital stock of the new company is \$4,500,000. It is to be exchanged for that of the several constituent companies, share for share, except in the case of the Conneaut Terminal, whose stockholders will receive two shares of the new for one of the old. The consolidated company will issue \$4,250,000 in bonds to redeem a like amount already issued by the Pittsburgh, Shenango & Lake Erie; \$150,000 to redeem bonds of the Erie Terminal, and the necessary amounts to take up other bonds; but the whole issue shall not exceed \$4,800,000.

**Richmond & West Point Terminal.**—Drexel, Morgan & Co. announce that they are now ready to go ahead with the reorganization of the Richmond Terminal and its allied properties of the Richmond & Danville and East Tennessee systems. Messrs. C. H. Coster, George Sherman and Anthony J. Thomas have undertaken to act as a committee for the purpose of carrying the reorganization into effect. The main features of the reorganization plan are as follows: A new company is to be formed which shall hold property and franchises of all the roads at present controlled by the Richmond Terminal Company. Upon this consolidated property it is proposed to issue a mortgage to be called the consolidated five per cent. bond, running 100 years, for \$140,000,000. This issue may be increased in order to purchase the Central Railroad of Georgia and the Cincinnati Southern, now leased to the C. N. O. & T. P. The present Terminal six per cent. bonds will get 35 per cent. par value of new bonds. No other Terminal security gets bonds. It is proposed to issue upon this consolidated property \$75,000,000 of 5 per cent. non-cumulative preferred stock and \$160,000,000 of common stock. Of this stock the Terminal 6 per cent. bonds secure 90 per cent. of their par. The Terminal collateral trust 5 per cent. bonds are to receive 70 per cent. in new preferred stock and 30 per cent. in common stock. The present Terminal preferred stock is to receive 35 per cent. in new preferred and 65 in new common. The present Terminal common is to pay an assessment of \$12.50 per share, for which they get new preferred stock at par, the new Terminal common being changed par for par with the old common.

It is proposed to have three trustees to hold all the stock to be issued for five years. A \$15,000,000 syndicate is said to have underwritten the new securities. They will take the new bonds at 85 per cent. and the common stock at 15.

**Sandusky & Columbus Short Line.**—A mortgage for \$1,000,000 has been filed in the counties in Ohio through which the road is built. It is in favor of the Metropolitan Trust Co., of New York, and provides for the issue of six per cent. bonds. The funds secured will be used for equipment and improvements.

**Toledo, St. Louis & Kansas City.**—In the United States Circuit Court at Toledo, O., on May 19, a receiver was appointed for the road. The order was granted by the United States Court on the application of Stout & Co., of New York, who claim to have a judgment of \$40,000 in the Common Pleas Court at Toledo, upon which execution has been returned unsatisfied. In their bill the plaintiffs say that a large number of unsecured claims are pending against the defendants in the States of Ohio, Indiana and Illinois, aggregating in all nearly \$1,000,000. Suits, they say, have been begun on many of these claims and others are about to be instituted, and the road is insolvent and unable to meet them. Judge Ricks appointed Samuel R. Calloway, of Toledo, the present President of the company, Receiver. Similar applications have been made before the United States Circuit Court at Chicago and Indianapolis. The road was formerly a narrow-gauge road running from Toledo to St. Louis, 450 miles. It was bought a few years ago by a syndicate composed of S. H. Kneeland and other Eastern men, who changed it to a standard gauge and otherwise improved the property.

#### TRAFFIC.

##### Traffic Notes.

The Canadian Pacific has issued a freight tariff from New York to Pacific Coast points on the basis of \$2.76 per 100 lbs. first class, which is about 10 per cent. below the rates recently established by the Sunset route of the Southern Pacific.

The Railroad Commissioners of Mississippi have ordered that the rate for a berth in a sleeping car in that state must not be over \$1 for 100 miles, and not over \$1.50 for distances greater than 100 miles. The Commissioners have also ordered the re-opening of a telegraph office which was closed without their consent.

It is announced in Philadelphia that the Pennsylvania, the Baltimore & Ohio and the Philadelphia & Reading have agreed to make an important advance in the rates on pig iron from points south of the Potomac River to all points on the lines of these roads. It is said that this is done to protect the Pennsylvania smelters. The amount of the increase is variously stated at from five cents a ton up to 60 cents a ton.

The Canadian Comptroller of Customs has issued a circular concerning sealed cars in transit through Canada in bond from one point in the United States to another point therein. Many customs officers at the frontier have been in the habit of accepting the American customs seals on the cars as sufficient, but the new order requires that Canadian customs seals must also be attached to the car, and places the cars completely under Canadian customs laws during their transit through Canada.

Negotiations are pending between Mr. C. P. Huntington, representing the Pacific Mail Steamship Company, and a committee of the Panama Railroad Company's directors, which, it is expected, will end the rate war between the two companies. As the Panama Railroad Company's contract with the North American Steamship Company on the Pacific Coast does not expire until May 1, 1894, a close contract such as existed formerly is not possible at present. It is said, however, that there is a desire on both sides to restore rates to a paying basis.

The Boston Fruit & Produce Exchange is greatly dissatisfied over the failure of the legislative committee to punish the New York, New Haven & Hartford for not carrying and delivering their perishable fruit in a satisfactory manner. It appears that the fruit dealers prefer to use the New York & New England road's freight

terminals, and are bound to have their freight come there; but the New England and the New Haven roads cannot or will not agree on arrangements for the joint conduct of the business, and so the freight comes into Boston by the Old Colony. The legislative committee reported, in substance, that the Massachusetts Railroad Commission or the Interstate Commerce Commission would be the proper tribunal to remedy the complaint.

The Pennsylvania has put on a new train between Pittsburgh and Chicago which will run as the first section of the Columbian express, leaving Pittsburgh at 8:15 p. m. It is announced in Boston that the through passenger train between Boston and Minneapolis over the Boston & Maine and the Canadian Pacific will, after June 1, run through in about 12 hours quicker time than at present. The Canadian Pacific train between Boston and Chicago will from that date have a tourist sleeping car on Mondays, Wednesdays and Fridays. The tourist car for St. Paul via the "Soo" will leave Boston on Thursdays. The fast mail train leaving New York over the New York Central at 4:25 a. m., and arriving in Albany about 8 a. m., is to be run through to Buffalo, arriving there at 4:20 p. m. On May 21, the Norfolk & Western added to its train service a new through train between Norfolk and Columbus, O.

President Jeffery, of the Denver & Rio Grande, talks to a reporter as follows about the settlement of the recent rate war:

"The first point was the demand of the Santa Fé that we limit our through trains to one each way daily. This request was an unusual one, a request without a parallel. We were compelled, by the volume of traffic and by our Eastern and Western connections, to run a number of trains, and I insisted that in all probability we would need more rather than fewer trains. . . . Finally the Santa Fé withdrew the request, and recurred to the proposition of March 29. This was agreed to, that the Midland should take 60 per cent. of the Aspen passenger pool, while we retained 40 per cent., regardless of the number of trains which should be run. A number of other minor matters were agreed upon."

Then President Reinhardt brought up his main grievance, that we had a majority in the Grand Junction line. As both companies were guarantors of the bonds, and should have joint and equal control, it was finally conceded that the Midland might purchase one-half of the excess stock held by us in this line. This puts both roads on an equality with regard to the junction line."

##### Chicago Traffic Matters.

CHICAGO, May 24, 1893. Contrary to what appeared probable in view of the generally admitted necessity for an agreement in the Western territory and which was expected to follow the settlement of the local differences in Colorado, no agreement has yet been reached in regard to either the adoption of the revised agreement of the Western Passenger Association or to the adoption of uniform World's Fair rates. The lines in interest were not able to agree upon rates for the Fair, nor upon the extension of the jurisdiction of the Western Passenger Association to the Trans-Missouri territory. Without a settlement of these questions, the Santa Fé was unwilling to reconsider its notice of withdrawal, which accordingly became effective May 20.

The Minneapolis & St. Louis, a part of the Albert Lea route, has also withdrawn from the Association, presumably in order that the Rock Island may be in position to protect itself against an extension of reduced rates up the Missouri River, which may eventually affect St. Paul. The Rock Island and the Burlington have not yet reduced their rates to the basis in effect via the Santa Fé, but are likely to do so before long, and the outlook for the maintenance of the rates originally agreed upon appears to be somewhat dubious. The trouble appears now to be that some of the lines are insisting that the \$45 round-trip rate from Colorado points, can be maintained, while others have all along insisted that it is too high. The Santa Fé announces that on May 29 it will put into effect the following rates: Round trip from Missouri River to Chicago, \$17.50; round trip from Denver to Chicago, \$37.50. The present rate of \$20 from Colorado common points to Missouri River points will be retained.

The Chicago lines, having discovered that lake and rail rates via East St. Louis were being quoted which were lower than the agreed rates via Chicago, have adopted the following resolution:

*Resolved,* That the boat lines by way of Chicago be authorized to issue the same rates to Upper Mississippi River points on shipments destined to points west of the west bank of the Mississippi River as are issued to East St. Louis via Toledo or Cleveland on through business, the lines west of Chicago to accept their proportion of the all-rail rate, provided such divisions do not give the boat lines to exceed their local rates to Chicago, it being understood that neither the boat nor the rail lines shall receive more than their locals.

The Central Traffic Association lines have declined to authorize a reduction in rates on grain and grain products to a basis of 22½ cents per 100 lbs., Chicago to New York.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines, for the week ending May 20, amounted to 52,343 tons, against 58,390 tons during the preceding week, an decrease of 6,047 tons, and against 51,336 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	W'k to May 20.		W'k to May 13.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central.....	7,037	13.5	6,745	12.8
Wabash.....	2,991	5.7	3,756	7.2
Lake Shore & Michigan South.	10,944	20.9	10,209	19.4
Pitts., Ft. Wayne & Chicago.	7,256	13.9	7,427	14.1
Pitts., Cin., Chicago & St. Louis	6,119	12.3	6,365	11.9
Baltimore & Ohio.....	3,338	6.4	3,283	6.3
Chicago & Grand Trunk.....	4,207	7.9	3,335	6.4
New York, Chic. & St. Louis....	3,185	6.1	4,913	9.4
Chicago & Erie.....	5,836	11.2	4,635	8.8
C., C. & St. Louis.....	1,129	2.1	1,950	3.7
Totals.....	52,343	100.0	52,536	100.0

Of the above shipments 2,794 tons were flour, 19,408 tons grain and millstuff, 6,500 tons cured meats, 10,998 tons dressed beef, 1,033 tons butter, 1,643 tons hides and 7,139 tons lumber. The three Vanderbilt lines carried 40.5 per cent., the two Pennsylvania lines 26.2 per cent. The Lake lines carried 63,005 tons, against 55,737 tons during the preceding week, an increase of 7,268 tons.